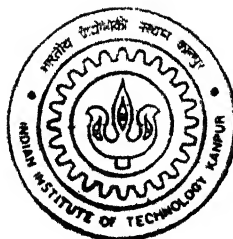


# INTELLIGENT MODEL FOR OPTIMAL CONTROL OF TARGET WINDOWS AT END POINT IN OXYGEN STEELMAKING

by  
DIVYESH DIXIT

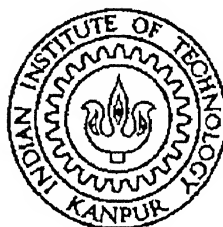


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DEPARTMENT OF MATERIALS AND METALLURGICAL ENGINEERING  
Indian Institute of Technology Kanpur  
February, 2001

# **INTELLIGENT MODEL FOR OPTIMAL CONTROL OF TARGET WINDOWS AT END POINT IN OXYGEN STEELMAKING**

A Thesis Submitted  
In Partial Fulfillment of the Requirements  
For the Degree of  
**MASTER OF TECHNOLOGY**  
By  
**DIVYESH DIXIT**  
(9910607)



To The  
**DEPARTMENT OF MATERIALS AND METALLURGICAL  
ENGINEERING  
IIT KANPUR  
FEBRUARY 2001**

14 MAY 2001/mmE

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**Dedicated to**  
Goddess SARASWATI, the source of all knowledge





## ***CERTIFICATE***

It is certified that the work contained in this thesis entitled **INTELLIGENT MODEL FOR OPTIMAL CONTROL OF TARGET WINDOWS AT END POINT IN OXYGEN STEELMAKING** has been carried out by Mr. Divyesh Dixit under my supervision and that this work has not been submitted elsewhere for the award of a degree.



27/02/2021

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Divyesh Dixit

IIT Kanpur

Feb 2001

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## List of symbols

HeatNo	Heat Number
Date	Date of production
ChargeNo	Charge Number
WBATH	Weight of bath, Kg
GRY	Weight of hot metal, Kg
GSCHROT	Weight of scrap, Kg
C0	Wt % carbon in hot metal
Mn0	Wt % manganese in hot metal
P0	Wt % phosphorus in hot metal
Si0	Wt % silicon in hot metal
LNSLF	Lance life
LIM1	Lime added during first part of blow, Kg
DOLO1	Dolomite added during first part of blow, Kg
ORE1	Ore added during first part of blow, Kg
RSL1	Return slag added before blowing, Kg
RDOLO1	Raw dolomite added during first part of blow, Kg
T1	Temperature at subblance measurement, $^{\circ}\text{K}$
C1	Wt% carbon in metal at subblance measurement
Mn1	Wt% manganese in metal at subblance measurement
P1	Wt% phosphorus in metal at subblance measurement
O21	Oxygen blown during first part of blow, $\text{m}^3$
O22	Oxygen blow during second part of blow, $\text{m}^3$
LIM2	Lime added during second part of blow, Kg
DOLO2	Dolomite added during second part of blow, Kg
ORE2	Ore added during second part of blow, Kg
RSL2	Return slag added before second part of blow, Kg
RDOLO2	Raw dolomite added during second part of blow, Kg
HL2	Lance height during second part of blow, cm

T2	Metal temperature at the end of blow, $^{\circ}\text{K}$
C2	Wt % carbon in metal at the end of blow
Mn2	Wt % manganese in metal at the end of blow
P2	Wt % phosphorus in metal at the end of blow
Oact2	Dissolved oxygen in metal at the end of blow, ppm
$\sigma$	Standard error of prediction
r	Correlation coefficient

# ABSTRACT

Introduction of subblance technology in the early eighties to analyze carbon and temperature in an Oxygen steelmaking converter during the blow, approximately 3-4 minutes before the end of blow, proved to be an important step in the control of oxygen steel making processes.

Once we have subblance temperature and carbon, the next step is to develop some models, which will predict end point temperature and composition, given all the process parameters and variables. In the present work, based on industrial data, linear models are developed for the prediction of endpoint temperature, carbon, manganese, phosphorus and dissolved oxygen in metal. The variables were passed through a stepwise selection scheme to find sensible variables. From these linear models, we observed that Lance height, Oxygen blown, dolomite added, ore added, raw dolomite added, return slag added, lime added (all during second blow) are all important process variables which affect the end point temperature and composition of the metal.

The next problem is to decide these process variables in advance, keeping in view the target end point temperature and composition. It is not possible to exactly match the target so a window around the target is constructed with lower and upper bound on each of the values. Our objective is that the heat should lie inside the window and as close as possible to the target value. The cost incurred due to deviation from target is minimized. We considered two components of cost, the cost due to deviation from target and the cost due to violation of window. The cost due to latter is much severe. We used micro genetic algorithm to minimize the cost and decide the process variables. It was found that in more than 95% heats we could reach within a narrow range of target end point temperature and composition.

# Chapter 1

## Introduction

Oxygen steel making process, now known by several names such as BOP, BOF, LD etc. is one of the most dynamic processes of steel making in which oxidation of dissolved elements like carbon, silicon, phosphorous and manganese take place simultaneously while the dissolved oxygen content and temperature of the bath increase towards the end of blow. The BOF process, due to its high productivity and excellent quality, has become most popular process for steel making. It however suffers from the drawback that it is difficult to get a simultaneous hit of target carbon content, molten steel temperature, phosphorus content, manganese content and dissolved oxygen of the bath at the turn-down.

Depending on the grade of steel, these variables are subjected to some quality constraints. Satisfying all the constraints simultaneously is not possible all the time. Therefore, we have to choose an optimum combination of the operating parameters so that the cost (or penalty) incurred is minimum. Genetic Algorithms (GA's) are natural choice in such complex multivariable optimization problems. Chapter 2 gives an introduction to genetic algorithms and micro GA and formulation of the optimization problem. For faster convergence micro GA is considered suitable.

The aim of this thesis is to develop prediction and optimization models for industrial end point control in 300 ton BOF. Several models are reported in literature for predicting end point variables, but in an earlier work [1], it was shown that in small range of operating variables, linear models do fairly well in predictions. In Appendix 1, a brief review of literature regarding models for predicting end point carbon is given. In chapter 4, development of linear models for the industrial data is discussed.

Results and discussions are described in chapters 4 and 5. Chapter 4 gives the results on linear models and their prediction while chapter 5 gives the results of intelligent optimization model and discusses them.

## **Chapter 2**

### **Intelligent optimization and control models**

#### ***2.1 Introduction***

Artificial intelligence techniques, such as genetic algorithms (GA) and neural nets have been used for both optimization and control purposes in steelmaking[2-6]. In the present work GA is used in combination with end point prediction equation for optimal control of BOF operation. A brief introduction to GA's, including an advanced algorithm called Micro-GA is given first followed by the technique of window formulation for end point temperature, carbon, manganese, phosphorus and dissolved oxygen. In the last part of the chapter the objective function for minimization is defined.

#### ***2.2 Genetic algorithms and micro-GA***

Genetic algorithms are search algorithms based on mechanics of natural selection and natural genetics. Considerable literature on GA's is now available[7]. GA's combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some of the innovative flair of human search. In every generation a new set of artificial creatures (strings) is created using bits and pieces of fittest of the old; an occasional new part is tried for good measure. While randomized, genetic algorithms are no simple random walk. They efficiently exploit historical information to speculate on new search points with expected improved performance. Genetic algorithms are now finding more widespread application in business, scientific and engineering circles. Genetic algorithms are very powerful and robust in solving complex and multimodal problems.

Genetic algorithm is a population-based algorithm, i.e. it works with a set of points in the search space. We first encode points into finite length binary string then we recursively apply some operators until we are able to find the optimum. These operators

generally are selection, crossover and mutation, although there are some other operators found in GA literature. In GA's we work with some initial number of strings and this remains constant in most of GA's. This number is called the **population size**.

The aim of selection process is to favor fitter individuals. The fitness of a string can be suitably defined in a maximization or minimization problem. There are several selection schemes available, which include Roulette wheel selection and tournament selection. In Roulette wheel selection the probability of selection of a string is directly proportional to its fitness. After selection the selected strings are crossed over.

The aim of crossover is to synthesize a possibly better string from two good strings. There are many types of crossover, which include Single point crossover and Uniform crossover. Uniform cross over is used in a special kind of genetic algorithm called micro GA. In single point cross over a random crossover site is generated and two parts of the crossing strings are swapped. These new string generated are called children while original strings are called parents. There is some probability that parent will not be replaced by children. The probability of replacement of parents by children is called **crossover probability**.

$$\begin{array}{ccc} 10001 & 010001 & \\ 11010 & 101111 & \end{array} \xrightarrow{\text{Cross Over}} \begin{array}{ccc} 10001 & 101111 & \\ 11010 & 010001 & \end{array}$$

In uniform crossover, bit-by-bit examination of strings is done and the corresponding bits are exchanged with some probability. The crossover probability here represents the probability of exchange of bits. A crossover probability of 0.5 represents very severe crossover in this case.

There is one operator, which is usually used to fine tune the optimum obtained. This is called mutation. In simplest kind of mutation called jump mutation we examine a single string bit by bit and change it with a certain small probability called **mutation probability**.



GA's are very computation intensive. The population size is large in case of normal GA's. Thus, sometimes GA's become slow in giving results. This can be very dangerous in critical application where time is very important. A new fast GA was developed by Krishnakumar[1], called micro GA. Micro GA uses a small population of 5 to 10 strings.

It uses uniform crossover and elitist selection scheme. In elitist selection scheme the maximum fitness string is always chosen. Micro GA is very successful in the case of non-stationary function, i.e. those functions that change with time and continuous optimization is needed. In case of process control of steel making we want to have fast results so we decided to use micro GA.

The GA driver was downloaded from the UIUC website. The program is written in Fortran. A description of the program is provided in Appendix 2. It was interfaced with programs using shell script and c programs to the data. We have created a package, which can be used to optimize a single heat also. The package is user friendly. The script of a session using the package is given in the Appendix 3.

### ***2.3 Window formulation for end point control***

A window defines the permitted upper and lower bounds for a given target or aim value. Lower and upper bounds are necessary because of stochastic nature as well as inherent variability of the BOF process. The objective is therefore to minimize the cost due to possible deviation from the aimed values for all parameters i.e., for temperature, carbon, phosphorus, manganese and dissolved oxygen at end point in a BOF. Depending upon the nature of variable, the cost arising due to deviations out of windows may be very high. These costs are also added to the original cost function. Thus our objective is to minimize total cost where

Total costs = Costs due to deviation from aim values + Costs due to deviation outside window

### 2.3.1 Carbon Window

Carbon window is formulated by allowing some predefined deviation from aim value. Care is taken that window's limit does not go beyond certain predefined minimum and maximum values. The minimum and maximum values are set because our regression equations were developed for a certain range of carbon only. The carbon window is given by

$$\Phi_c \leq \xi_c \leq \Psi_c$$

where  $\xi_c$  is predicted carbon,  $\Phi_c$  and  $\Psi_c$  are the lower and upper limits of window, respectively.

here

$$\Phi_c = \begin{cases} c_{aim} - \sigma_{lc} & \text{if } \Phi_c \geq 0.030 \\ 0.030 & \text{if } \Phi_c < 0.030 \end{cases}$$

and

$$\Psi_c = \begin{cases} c_{aim} + \sigma_{uc} & \text{if } \Psi_c \geq 0.066 \\ 0.066 & \text{if } \Psi_c < 0.066 \end{cases}$$

where  $\sigma_{lc}$  and  $\sigma_{uc}$  are lower and upper limits of deviation allowed. In this case  $\sigma_{lc}$  and  $\sigma_{uc}$  are one and the same and they are set equal to the  $\sigma_c$ , which is the standard error for prediction of carbon.

### 2.3.2 Temperature window

Similar to carbon window, the temperature window is formulated as

$$\Phi_T \leq \xi_T \leq \Psi_T$$

where,  $\xi_T$  is predicted temperature,  $\Phi_T$  and  $\Psi_T$  are the lower and upper limits of window. Here,  $\Phi_T = T_{aim} - \sigma_{lt}$  and  $\Psi_T = T_{aim} + \sigma_{ut}$ .  $\sigma_{lt}$  and  $\sigma_{ut}$  are the allowed upper and lower deviations allowed.

In our work, we have chosen  $\sigma_{lt} = 5^\circ\text{C}$  and  $\sigma_{ut} = 15^\circ\text{C}$  because higher temperature can be easily brought down by adding coolants (or by allowing the converter to idle) but when temperature is lower than target, reblowing may be needed else there will be problems at the casting station. This problem is however less acute when ladle furnace is available for temperature and composition adjustments at a later stage.

### ***2.3.3 Phosphorus window***

No lower limit is specified for phosphorus in this work. It is assumed a priori that any lower value than aimed is an advantage in terms of minimizing the adverse effects of phosphorus on ultimate steel quality. Phosphorus window is given by,

$$\xi_P \leq P_{aim}$$

where  $\xi_P$  is predicted phosphorus and  $P_{aim}$  is aim phosphorus.

### ***2.3.4 Manganese window***

Manganese window is formulated similar to phosphorus window and is given by,

$$\xi_{Mn} \leq (Mn_{aim} + 0.03)$$

where  $\xi_{Mn}$  is predicted manganese and  $Mn_{aim}$  is aim manganese. We allowed some deviation above aim value because manganese is not as harmful as phosphorus.

### ***2.3.5 Dissolved oxygen window***

Dissolved oxygen window is given by

$$\Phi_{[O]} \leq \xi_{[O]} \leq \Psi_{[O]}$$

where  $\xi_{[O]}$  is predicted dissolved oxygen,  $\Phi_{[O]}$  and  $\Psi_{[O]}$  are the lower and upper limits of window respectively, Here  $\Phi_{[O]} = [O]_{aim} - \sigma_{[O]}$  and  $\Psi_{[O]} = [O]_{aim} + \sigma_{[O]}$ , where  $\sigma_{[O]}$  is the allowed deviation for dissolved oxygen window. We have used  $\sigma_{[O]}$  as 162 ppm.

## ***2.4 Objective function for optimization***

There are two components of costs. The first component is due to deviation from aim values and the second component is due to violation of window limits. These costs are defined below.

### **-Costs for deviation for aim values**

Temperature: 1 cost point for each degree Kelvin deviation from aim value. For example if our aim temperature is 1672 K and predicted temperature is 1666K cost will be  $(1672 - 1666) = 6$  points.

Carbon, phosphorus, manganese, dissolved oxygen: 1 cost point for each one percent deviation from aim value. For example if aim carbon=0.040 and predicted carbon=0.042 then  $Cost = (0.042 - 0.040) * 100 / 0.040 = 0.002 * 100 / 0.040 = 5$  points.

### **-Costs for violation of windows:**

Inside the window cost is zero. Outside the window the cost is decided on the basis of distance from the window boundary. These costs are 10 times higher than the inside costs as defined earlier. Thus, Carbon component of cost can be written as

$$F_c = \frac{\|\xi_c - C_{aim}\| * 100}{C_{aim}} + \frac{\langle \Phi_c - \xi_c \rangle * 1000}{C_{aim}} + \frac{\langle \xi_c - \Psi_c \rangle * 1000}{C_{aim}}$$

where  $\|x\|$  represents the absolute value of x and  $\langle \rangle$  is bracket operator function.

$$\langle x \rangle = \begin{cases} 0 & \text{if } x < 0 \\ x & \text{if } x \geq 0 \end{cases}$$

Similar equations can be written for other components of cost. These are:

-for temperature

$$F_T = \|\xi_T - T_{aim}\| + \langle \Phi_T - \xi_T \rangle * 10 + \langle \xi_T - \Psi_T \rangle * 10$$

-for phosphorus

$$F_P = \frac{\|\xi_P - P_{aim}\| * 100}{P_{aim}} + \frac{\langle \xi_P - P_{aim} \rangle * 1000}{P_{aim}}$$

-for manganese

$$F_{Mn} = \frac{\|\xi_{Mn} - Mn_{aim}\| * 100}{Mn_{aim}} + \frac{\langle \xi_{Mn} - Mn_{aim} - 0.03 \rangle * 1000}{Mn_{aim}}$$

-and for oxygen

$$F_{[O]} = \frac{\|\xi_{[O]} - [O]_{aim}\| * 100}{[O]_{aim}} + \frac{\langle \Phi_{[O]} - \xi_{[O]} \rangle * 1000}{[O]_{aim}} + \frac{\langle \xi_{[O]} - \Psi_{[O]} \rangle * 1000}{[O]_{aim}}$$

The total cost ( $F_{total}$ ) is obtained by adding all these costs and the objective of genetic algorithm is to minimize the total cost  $F_{total}$ .

$$F_{total} = F_C + F_T + F_P + F_{Mn} + F_{[O]}$$

## Chapter 3

### The Plant Data

The industrial data was acquired for a 300-ton converter. For this converter there are altogether 4 datasets comprising of 297, 200, 100 and 100 heats, respectively. These datasets are named as D1, D2, D3 and D4, respectively and are listed in the Appendix 4. The first dataset D1 contains all the information about the variables listed in the Table 3.0. This data set was used to develop the basic linear regression equations. The next data set D2 (containing 200 heats) was named as target dataset as it contained the targeted values of end point variables, carbon, temperature, manganese, dissolved oxygen and phosphorus. The next two datasets D3 and D4 (of 100 heats each) contained information about all the variables without any target values.

According to operational restrictions, ore ORE2 and raw dolomite RDOLO2 cannot be added together in the second part of blow. Due to this constraint we partitioned the datasets further into three parts. First group consists of heats in which the variables both Ore2 and Rdolo2 are zero. In second group of heats, Rdolo2 is nonzero while Ore2 is zero. In third group of heats, Ore2 is nonzero while Rdolo2 is zero. We partitioned the original dataset D1 of 297 heats into these three groups. As a result first group contained 110 heats, second contained 111 heats, and the third contained 60 heats. The remaining 16 heats were rejected as they violated the operational restrictions.

The plant data consisted several variables, which are explained in Table 3.1. Table 3.2-3.3 give the statistics of the data for the dataset D1, D2, D3 and D4, separately. Besides these original variables, certain variables, which are considered to be fundamental in the steel making process, were also tried in linear regression models. These variables are as follows:

**(i) Hot Ratio (HTR):** Hot ratio is defined as the ratio of weight of hotmetal to the weight of scrap. This affects both the temperature and composition of bath. For example; consider heat number 1739 of dataset D1

Hot metal weight=271900 Kg

Scrap weight=52000 Kg

$$\begin{aligned}\text{Thus, hot ratio HTR} &= \frac{271900}{52000} \\ &= 5.229\end{aligned}$$

**(ii) Basicity (BAS):** Slag consists of CaO, SiO<sub>2</sub> and other oxides. While CaO is basic in nature, SiO<sub>2</sub> is acidic in nature. The nature of slag has a profound effect on the refining process in steelmaking. In our calculations we have defined basicity as:

$$BAS = \frac{LIM1 + DOLO1}{WSiO_2}$$

where 
$$WSiO_2 = GRY * \frac{Si0}{100} * \frac{60}{28}$$

For example; consider heat number 1739 of dataset D1

LIM1=lime added during first blow;11231 Kg; GRY=Weight of hot metal =271900 Kg; Si0=hot metal silicon=0.556 %;

$$WSiO_2 = 271900 * \frac{0.556}{100} * \frac{60}{28} = 3239.5 \text{ Kg}$$

$$\text{Basicity } BAS = \frac{11231}{3239.5} = 3.4669$$

**(iii) Slag Volume (SVOL):** During the blow, oxygen is blown with supersonic jets at very high speed, so the metal droplets are thrown into the slag. These droplets travel through slag and react with it. Thus the amount of slag has a significant effect on the refining process. We assumed that slag volume is proportional to the slag mass, thus we used slag mass in regression models. Slag volume is defined as:



$$SVOL = WSiO_2 + LIM1 + RSL1$$

For example; consider heat number 1739 of dataset D1

$WSiO_2=3239.5$  Kg;  $LIM1=11231$  Kg;  $RSL1=3346$  Kg

Slag volume  $SVOL=3239.5+11231+3346=17816.5$

Table 3.1 Variables defined in plant data

Variable	Full Name	Unit
HeatNo	Heat Number	-----
Date	Date of production	-----
ChargeNo	Charge Number	-----
WBATH	Weight of bath	Kg
GRY	Weight of hot metal	Kg
GSCHROT	Weight of scrap	Kg
C0	Wt % carbon in hot metal	Wt%
Mn0	Wt % manganese in hot metal	Wt%
P0	Wt % phosphorus in hot metal	Wt%
Si0	Wt % silicon in hot metal	Wt%
LNSLF	Lance life	Number of heats
LIM1	Lime added during first part of blow	Kg
DOLO1	Dolomite added during first part of blow	Kg
ORE1	Ore added during first part of blow	Kg
RSL1	Return slag added before blowing	Kg
RDOLO1	Raw dolomite added during first part of blow	Kg
T1	Temperature at sublance measurement	<sup>0</sup> K
C1	Wt% carbon in metal at sublance measurement	Wt%
Mn1	Wt% manganese in metal at sublance measurement	Wt%
P1	Wt% phosphorus in metal at sublance measurement	Wt%
O21	Oxygen blown during first part of blow	Nm <sup>3</sup>
O22	Oxygen blow during second part of blow	Nm <sup>3</sup>
LIM2	Lime added during second part of blow	Kg
DOLO2	Dolomite added during second part of blow	Kg
ORE2	Ore added during second part of blow	Kg
RSL2	Return slag added before second part of blow	Kg
RDOLO2	Raw dolomite added during second part of blow	Kg
HL2	Lance height during second part of blow	Cm
T2	Metal temperature at the end of blow	<sup>0</sup> K
C2	Wt % carbon in metal at the end of blow	Wt%
Mn2	Wt % manganese in metal at the end of blow	Wt%
P2	Wt % phosphorus in metal at the end of blow	Wt%
Oact2	Dissolved oxygen in metal at the end of blow	ppm

Table 3.2 Summary of datasets D1 and D2

Variable	D1			D2		
	Range	Mean	$\sigma$	Range	Mean	$\sigma$
Heat No.	1739-2545	-----	-----	2251-3331	-----	-----
Date	01SEP00- 23SEP00	-----	-----	23SEP00- 10OCT00	-----	-----
Charge No.	-----	-----	-----	-----	-----	-----
WBATH	262900- 352700	320208	11652	292400- 336800	319491	8864
GRY	250000- 311600	289803	11656	250200- 308200	288901	10596
GSCH- ROT	35300-73400	53843	8204	34600-73400	54287	7395
C0	4.2640-4.9900	4.6688	0.1047	4.2860-4.8650	4.6695	0.0917
Mn0	0.2970-0.4740	0.3886	0.0381	0.2990-0.4260	0.3739	0.0221
P0	0.0530-0.0660	0.0579	0.0023	0.0520-0.0640	0.0574	0.0021
Si0	0.2760-0.9670	0.4933	0.1258	0.1360-0.8160	0.4158	0.1079
LNSLF	1-225	69.78	50.34	0-201	95.180	56.2759
LIM1	8512-20041	14527	2814	8545-20035	13998	2628
DOLO1	0-0	0	0	0-0	0	0
ORE1	0-11947	4447	2516	0-8567	3433	2205
RSL1	0-6921	3654	911	2-7003	3630	950
RDOLO1	0-4523	630	723	0-2001	674	566.6
T1	1516-1665	1602.64	22.97	15225-1666	1606	24.07
C1	0.1120-0.7870	0.3367	0.1117	0.111-0.727	0.3409	0.1213
Mn1	0.1240-0.3990	0.2931	0.0428	0.156-0.387	0.2980	0.034
P1	0.0040-0.0510	0.0248	0.0083	0.006-0.059	0.0295	0.0089
O21	10398-14982	12971.6	800.7	10527-14104	12864	683
O22	1146-3582	1996.6	359.0	1243-3330	1993	370.8
LIM2	0-503	19.24	94.78	0-502	14.91	84.78
DOLO2	0-2003	86.17	394.11	0-0	0	0
ORE2	0-1401	181.31	336.70	0-15225	273.21	352.65
RSL2	0-2527	114.84	429.36	0-3258	130.89	480.15
RDOLO2	0-3969	376.84	642.24	0-2276	305	461.62
HL2	143-249	208.43	19.21	136-230	185	26.14
T2	1599-1708	1667.31	18.68	1618-1713	1668	18.08
C2	0.030-0.0840	0.0486	0.0083	0.03-0.087	0.0473	0.0088
Mn2	0.063-0.270	0.1563	0.0343	0.075-0.245	0.1620	0.0313
P2	0.004-0.028	0.0107	0.0034	0.004-0.023	0.0120	0.0038
Oact2	266-1371	735.53	239.68	288-1178	652.32	180.42

Table 3.3 Summary of datasets D3 and D4

Variable	D3			D4		
	Range	Mean	$\sigma$	Range	Mean	$\sigma$
Heat No.	3337-3685	-----	-----	3687-3971	-----	-----
Date	10OCT00- 19OCT00	-----	-----	19OCT00- 24OCT00	-----	-----
Charge No.	-----	-----	-----	-----	-----	-----
WBATH	289500-331700	315965	8507	290100-336100	319766	6773.9
GRY	250000-307600	287929	11656	250100-297800	282915	9617.5
GSCH- ROT	35800-68300	54475	8254	46700-7800	62187	8158.0
C0	4.3340-4.891	4.6829	0.1107	4.574-4.856	4.7128	0.0593
Mn0	0.323-0.422	0.3753	0.0216	0.33-0.399	0.3696	0.0144
P0	0.015-0.083	0.0609	0.0040	0.051-0.064	0.058	0.0029
Si0	0.2460-0.815	0.4443	0.1038	0.315-0.66	0.4758	0.0645
LNSLF	0-242	166.42	58.80	0-225	49	47.11
LIM1	7166-20791	12770	2523	7202-16805	9324	1894.7
DOLO1	0-5994	683	1638	0-7938	3828	1680.9
ORE1	0-9159	3605	2479	200-8594	4487	1608.5
RSL1	0-4748	2916	1316	0-3481	874	707.58
RDOLO1	0-2008	483	531.8	0-3663	149	616.03
T1	1538-1679	1610	28.19	1536-1665	1613	24.31
C1	0.127-0.824	0.3813	0.1208	0.161-0.723	0.3916	0.1132
Mn1	0.184-0.378	0.2853	0.0398	0.148-0.329	0.2319	0.0473
P1	0.01-0.53	0.0262	0.0088	0.006-0.04	0.0214	0.0076
O21	10554-15400	12984	762.17	11102-14101	13102	464.28
O22	1348-3193	2068	359.84	1508-3496	2085	346.81
LIM2	0-2038	50.57	243.62	0-507	25.1	109.36
DOLO2	0-1992	20	198.2	0-0	0	0
ORE2	0-1049	249.7	363.46	0-4022	270.3	517.5
RSL2	0-3605	217	625.38	0-5014	523.28	1097.7
RDOLO2	0-2532	342	590	0-1261	185	336.04
HL2	169-246	215	15.69	138-249	196	15.51
T2	1624-1723	1670	19.4	1622-1714	1668	15.71
C2	0.032-0.105	0.0558	0.0141	0.03-0.109	0.0588	0.0142
Mn2	0.085-0.261	0.1565	0.0303	0.083-0.211	0.1421	0.0281
P2	0.005-0.031	0.0113	0.0039	0.004-0.018	0.0094	0.0026
Oact2	242-1522	590.64	265.71	240-940	453.92	112.21

## Chapter 4

### Linear prediction models

#### *4.1 Development of prediction models for end point*

Linear prediction models for end point prediction were developed using Nag routines. These Nag routines are available as standard nag libraries, which can be called in Fortran programs. The routine G02EEF was used to select the significant variables from the list of all possible independent variables, which may affect the dependent variable. The routine G02BAF was used to generate the moments from the data. These moments are used by routine G02CGF to finally give the linear models.

Besides these linear models, exponential model of carbon, in which a linear prediction equation for capacity mass transfer is used, is also developed.

#### *4.2 Results of multiple linear regressions*

The results of linear regression runs are summarized in Tables 4.1-4.15. Exponential regression models for carbon, in which a linear prediction equation for capacity mass transfer coefficient is used, are summarized in Tables 4.16-4.18. The dataset D1 consisting of 297 heats, which was partitioned into three groups, was used in these regression runs. The table 4.0 gives a summary of these regression runs.

##### *4.2.1 Sample calculations*

Sample calculations for the linear prediction models described in Tables 4.1-4.15, for a single heat are given below.

-Table 4.1: In Heat No. R1751, C1=0.239, O22=1802, SVOL=21978

Calculated C2=0.239\*0.0421385+1802\*-0.000013575+21978\*0.000000442+0.050873

$$=0.04619 \text{ (Actual 0.040)}$$

-Table 4.2: In Heat No. R1739, C1=0.441, O22=2240, HL2=217, SVOL=17816

$$\begin{aligned} \text{Calculated C2} &= 0.05006*0.441-0.0000219*2240+0.000114*217+0.000000689*17816+ \\ &0.038 \\ &= 0.0480 \text{ (Actual 0.043)} \end{aligned}$$

-Table 4.3: In Heat No. R1752, C1=0.348, O22=1995, LIM2=0, ORE2=460, HL2=238

$$\begin{aligned} \text{Calculated C2} &= 0.060*0.348-0.00002847*1995+0.000008546*460+0.0001774*238 \\ &+0.04166 \\ &= 0.0519 \text{ (Actual 0.050)} \end{aligned}$$

-Table 4.4: In Heat No. R1751, T1=1611, O22=1802, LIM2=0, HL2=213, HTR=6.672

$$\begin{aligned} \text{Calculated T2} &= 0.9608*1611+0.0438*1802-0.0117*0+0.0751*213+1.107*6.672+25.05 \\ &= 1675.20 \text{ (Actual 1685)} \end{aligned}$$

-Table 4.5: In Heat No. R1739, T1=1561, O22=2240, LIM2=0, DOLO2=0, RSL2=0, RDOLO2=1516, HL2=217

$$\begin{aligned} \text{Calculated T2} &= 0.8868*1561+0.03564*2240-0.00807*1516-0.0885*217+197.62 \\ &= 1630.31 \text{ (Actual 1625)} \end{aligned}$$

-Table 4.6: In Heat No. R1752, T1=1620, O22=1995, ORE2=460, RSL2=0, HL2=238, HTR=6.39

$$\begin{aligned} \text{Calculated T2} &= 0.9033*1620+0.0434*1995-0.0156*460-0.171*238+2.16*6.39+169.405 \\ &= 1685.26 \text{ (Actual 1690)} \end{aligned}$$

-Table 4.7: In Heat No. R1751, Mn0=0.372, T1=1611, C1=0.239, O22=1802, HL2=213, C2=0.04619(predicted), SVOL=21978, HTR=6.672, BAS=4.678

$$\begin{aligned} \text{Calculated Mn2} &= 0.3005*0.372+0.00074*1611+0.172*0.239-0.0000368*1802 \\ &+0.00013*213+1.287*0.04619-0.00000246*21978-0.00365*6.672 \\ &+0.0039*4.678-1.163176 \end{aligned}$$

$$= 0.143 \text{ (Actual 0.149)}$$

-Table 4.8: In Heat No. R1739, Mn0=0.352, T1=1561, C1=0.441, O22=2240, DOLO2=0, RDOLO2=1516, T2=1630.31(Calculated), C2=0.048(Calculated), SVOL=17816, BAS=3.4669

$$\begin{aligned} \text{Calculate Mn2} &= 0.3155*0.352+0.00133*1561+0.1899*0.441-0.0000306*2240- \\ &\quad 0.000019*1516-0.00029*1630.31+1.06*0.048-0.0000038*17816- \\ &\quad 0.00298*3.469-1.5542 \\ &= 0.119 \text{ (Actual 0.105)} \end{aligned}$$

-Table 4.9: In Heat No. R1752, Mn0=0.381, T1=1620, C1=0.348, O22=1995, LIM2=0, DOLO2=0, ORE2=460, RSL2=0, T2=1685(Calculated), C2=0.0519(Calculated), SVOL=25717, BAS=4.34

$$\begin{aligned} \text{Calculated Mn2} &= 0.2877*0.381+0.00113*1620+0.1926*0.348-0.0000253*1995- \\ &\quad 0.0000275*460-0.000195*1685+1.134*0.0519-0.0000023*25717- \\ &\quad 0.0032*4.34-1.4234 \\ &= 0.178 \text{ (Actual 0.184)} \end{aligned}$$

-Table 4.10: In Heat No. R1751 P0=0.0579, DOLO2=0, HL2=213, T2=1675(predicted), C2=0.04619(predicted), Mn2=0.143(predicted), SVOL=21978, HTR=6.671940

$$\begin{aligned} \text{Calculated P2} &= 0.263*0.0579+0-0.0000288*213+0.000043*1675-0.069*0.04619 \\ &\quad +0.069*0.143-0.000000229*21978+0.00028*6.67194-0.075205 \\ &= 0.00943 \text{ (Actual 0.0100)} \end{aligned}$$

-Table 4.11: For example, in Heat No. R1739, P0=0.059, HL2=217, T2=1630.31 (Calculated), C2=0.048(Calculated), Mn2=0.119(Calculated), SVOL=17816

$$\begin{aligned} \text{Calculated P2} &= 0.3158*0.059-0.0000325*217+0.0000957*1630.31+0.0939*0.048+ \\ &\quad 0.0507*0.119-0.000000445*17816-0.162815 \\ &= 0.00739 \text{ (Actual 0.007)} \end{aligned}$$

Table 4.0 Summary of regression results on the dataset D1 of appendix 1

Reference table	Linear Model description	Special constraints	Data set Location	Accuracy of prediction
Table 4.1	End point carbon control	Ore2=0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0053$ $r=0.6540$
Table 4.2	End point carbon control	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	$\sigma=0.0069$ $r=0.6138$
Table 4.3	End point carbon control	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0064$ $r=0.6963$
Table 4.4	End point temperature control	Ore2=0 Rdolo2=0	D1 Appendix 1	$\sigma=6.4039$ $r=0.9059$
Table 4.5	End point temperature control	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	$\sigma=8.4678$ $r=0.9031$
Table 4.6	End point temperature control	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	$\sigma=7.9845$ $r=0.9241$
Table 4.7	Dissolved oxygen control	Ore2=0 Rdolo2=0	D1 Appendix 1	$\sigma=189.1887$ $r=0.6778$
Table 4.8	Dissolved oxygen control	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	$\sigma=142.1239$ $r=0.7720$
Table 4.9	Dissolved oxygen control	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	$\sigma=134.7646$ $r=0.7715$
Table 4.10	End point manganese control	Ore2=0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0132$ $r=0.9292$
Table 4.11	End point manganese control	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	$\sigma=0.0130$ $r=0.9408$
Table 4.12	End point manganese control	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0143$ $r=0.8864$
Table 4.13	End point phosphorus control	Ore2=0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0018$ $r=0.8182$
Table 4.14	End point phosphorus control	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	$\sigma=0.0023$ $r=0.8308$
Table 4.15	End point phosphorus control	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	$\sigma=0.0021$ $r=0.7155$
Table 4.16	Carbon mass transfer coefficient near end point	Ore2=0 Rdolo2=0	D1 Appendix 1	-----
Table 4.17	Carbon mass transfer coefficient near end point	Ore2=0 Rdolo2 $\neq$ 0	D1 Appendix 1	-----
Table 4.18	Carbon mass transfer coefficient near end point	Ore2 $\neq$ 0 Rdolo2=0	D1 Appendix 1	-----



Table 4.1 Summary of linear prediction model for C2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>C2</b> ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	C1 O22 SVOL CONSTANT	0.042138504 -0.000013575 0.000000442 0.050873	$\sigma=0.0053$ $r=0.6540$

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.2 Summary of linear prediction model for C2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>C2</b> ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	C1 O22 HL2 SVOL CONSTANT	0.050060497 -0.000021931 0.000114168 0.000000689 0.038007	$\sigma=0.0069$ $r=0.6138$

\*Group 2 consists of heats for which RDOLO2 $\neq$ 0 and ORE2=0

Table 4.3 Summary of linear prediction model for C2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>C2</b> ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	C1 O22 LIM2 ORE2 HL2 CONSTANT	0.060102077 -0.000028469 -0.000023615 0.000008546 0.000177401 0.041659	$\sigma=0.0064$ $r=0.6963$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2 $\neq$ 0

Table 4.4 Summary of linear prediction model for T2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>T2</b> ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	T1 O22 LIM2 HL2 HTR CONSTANT	0.960814354 0.043802837 -0.011723530 0.075109580 1.107001549 25.050055	$\sigma=6.4039$ $r=0.9059$

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.5 Summary of linear prediction model for T2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>T2</b> ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	T1 O22 LIM2 DOLO2 RSL2 RDOLO2 HL2 CONSTANT	0.886800372 0.03564128 -0.021140074 -0.004277747 -0.008669891 -0.008073328 -0.088514272 197.619990	$\sigma=8.4678$ $r=0.9031$

\*Group 2 consists of heats for which RDOLO2 $\neq$ 0 and ORE2=0

Table 4.6 Summary of linear prediction model for T2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>T2</b> ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	T1 O22 ORE2 RSL2 HL2 HTR CONSTANT	0.903288146 0.043384088 -0.015635069 -0.006714139 -0.17097950 2.161500311 169.405449	$\sigma=7.9845$ $r=0.9241$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2 $\neq$ 0

Table 4.7 Summary of linear prediction model for Mn2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Mn2</b> ORE2=0 RDOLO2=0	Mn0,T1,C1,O22, LIM2,DOLO2, RSL2,HL2, T2,C2,SVOL,HTR, BAS	Mn0 T1 C1 O22 HL2 C2 SVOL HTR BAS CONSTANT	0.300525655 0.000741625 0.171760349 -0.000036792 0.000130775 1.287354594 -0.000002459 -0.003649055 0.003902635 -1.163176	$\sigma=0.0132$ $r=0.9292$

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.8 Summary of linear prediction model for Mn2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Mn2</b> ORE2=0 RDOLO2 $\neq$ 0	Mn0,T1,C1,O22, LIM2,DOLO2, RSL2,RDOLO2, HL2,T2,C2,SVOL, HTR,BAS	Mn0 T1 C1 O22 DOLO2 RDOLO2 T2 C2 SVOL BAS CONSTANT	0.315546534 0.001328585 0.189916495 -0.000030600 -0.000004419 -0.000019065 -0.000291708 1.061411681 -0.000003804 -0.002979311 -1.554208	$\sigma=0.0130$ $r=0.9408$

\*Group 2 consists of heats for which RDOLO2 $\neq$ 0 and ORE2=0

Table 4.9 Summary of linear prediction model for Mn2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Mn2</b> ORE2 $\neq$ 0 RDOLO2=0	Mn0,T1,C1,O22, LIM2,DOLO2, ORE2,RSL2, HL2,T2,C2,SVOL, HTR,BAS	Mn0 T1 C1 O22 LIM2 DOLO2 ORE2 RSL2 T2 C2 SVOL BAS CONSTANT	0.287657475 0.001126155 0.192631598 -0.000025336 -0.000046660 -0.000008290 -0.000027500 -0.000005548 -0.000194654 1.134257008 -0.000002313 -0.003202942 -1.423426	$\sigma=0.0143$ $r=0.8864$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2 $\neq$ 0

Table 4.10 Summary of linear prediction model for P2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>P2</b> ORE2=0 RDOLO2=0	P0,T1,C1,O22, LIM2,DOLO2, RSL2,HL2,T2, C2,Mn2,SVOL, HTR,BAS	P0 DOLO2 HL2 T2 C2 Mn2 SVOL HTR CONSTANT	0.262965456 0.000001515 -0.000028851 0.000043017 -0.060858325 0.069068364 -0.000000229 0.000281388 -0.075205	$\sigma=0.0018$ $r=0.8182$

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.11 Summary of linear prediction model for P2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>P2</b> ORE2=0 RDOLO2 $\neq$ 0	P0,T1,C1,O22, LIM2,DOLO2, RSL2,RDOLO2, HL2,T2,C2,Mn2, SVOL,HTR,BAS	P0 HL2 T2 C2 Mn2 SVOL CONSTANT	0.315780703 -0.000032456 0.000095672 0.093936674 0.050712348 -0.000000445 -0.162815	$\sigma=0.0023$ $r=0.8308$

\*Group 2 consists of heats for which RDOLO2 $\neq$ 0 and ORE2=0

Table 4.12 Summary of linear prediction model for P2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>P2</b> ORE2 $\neq$ 0 RDOLO2=0	P0,T1,C1,O22, LIM2,DOLO2, ORE2,RSL2, HL2,T2,C2,Mn2, SVOL,HTR,BAS	P0 ORE2 HL2 T2 Mn2 SVOL CONSTANT	0.234064707 -0.000002757 -0.000042313 0.000027988 0.047250703 -0.000000361 -0.038820	$\sigma=0.0021$ $r=0.7155$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2 $\neq$ 0

Table 4.13 Summary of linear prediction model for Oact2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Oact2</b> ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, T2,C2,SVOL,HTR, BAS	LIM2 DOLO2 HL2 C2 CONSTANT	0.362841895 0.109714957 -3.807404690 -19791.21856 2503.654180	$\sigma=189.1887$ $r=0.6778$

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.14 Summary of linear prediction model for Oact2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Oact2</b> ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, T2,C2,SVOL,HTR, BAS	T1 C1 LIM2 RSL2 RDOLO2 T2 C2 HTR CONSTANT	-11.51006726 -1181.147900 0.352647390 0.187922487 0.082205909 12.725908627 -3546.561199 -24.49704435 -1367.055692	$\sigma=142.1239$ $r=0.7720$

\*Group 2 consists of heats for which RDOLO2 $\neq$ 0 and ORE2=0

Table 4.15 Summary of linear prediction model for Oact2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>Oact2</b> ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2,T2, C2,SVOL,HTR, BAS	LIM2 ORE2 HL2 C2 CONSTANT	-.381741035 -.127769642 -2.478146971 -17065.111683 2138.106569	$\sigma=134.7646$ $r=0.7715$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2 $\neq$ 0

Table 4.16 Summary of exponential prediction model for C2 using dataset D1 (group1)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>k</b> ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	C1 O22 SVOL CONSTANT	0.014427903 -0.000003647 -0.000000067 0.015946	$\sigma=0.0011$ $r=0.7812$

Table 4.17 Summary of exponential prediction model for C2 using dataset D1 (group2)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>k</b> ORE2=0 RDOLO2 ≠ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	T1 C1 O22 LIM2 HL2 SVOL HTR CONSTANT	-0.000008623 0.010516247 -0.000003611 -0.000000784 -0.000015054 -0.000000091 0.000167811 0.033548	$\sigma=0.0010$ $r=0.7082$

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.18 Summary of exponential prediction model for C2 using dataset D1 (group3)\*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
<b>k</b> ORE2 ≠ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	C1 O22 ORE2 HL2 CONSTANT	0.013677933 -0.000002201 -0.000001552 -0.000026113 0.018160	$\sigma=0.0014$ $r=0.6943$

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

-Table 4.12: In Heat No. R1752, P0=0.060, ORE2=460, HL2=238, T2=1685(Calculated), Mn2=0.178(Calculated), SVOL=25717

$$\begin{aligned}\text{Calculated P2} &= 0.234*0.060-0.000002757*460-0.000042*238+0.000028*1685+ \\ &\quad 0.047*0.178-0.00000036*25717-0.03882 \\ &= 0.0102 \text{ (Actual 0.011)}\end{aligned}$$

-Table 4.13: In Heat No. R1751, LIM2=0, DOLO2=0, HL2=213, C2=0.04619(predicted)

$$\begin{aligned}\text{Calculated Oact2} &= 0.3628*0+0.1097*0-3.8074*213-19791*0.04619+2503.654 \\ &= 778.5 \text{ (Actual 886)}\end{aligned}$$

-Table 4.14: In Heat No. R1739, T1=1561, C1=0.441, LIM2=0, RSL2=0, RDOLO2=1516, T2=1630.31(Calculated), C2=0.048(Calculated), HTR=5.229

$$\begin{aligned}\text{Calculated Oact2} &= -11.51*1561-1181*0.441+0.0822*1516+12.726*1630.31- \\ &\quad 3546*0.048-24.497*5.229-1367 \\ &= 718 \text{ (Actual 618)}\end{aligned}$$

-Table 4.15: In Heat No. R1752, LIM2=0, ORE2=460, HL2=238, C2=0.0519(Calculated)

$$\begin{aligned}\text{Calculated Oact2} &= -0.12777*460-2.478*238-17065*0.0519+2138.1 \\ &= 603.89 \text{ (Actual 579)}\end{aligned}$$

-Table 4.16: In Heat No. R1751, C1=0.239, O22=1802, SVOL=21978

$$\begin{aligned}\text{Calculated mass transfer coefficient k} &= 0.0144279*0.239-0.000003647*1802- \\ &\quad 0.0000000067*21978+0.015946 \\ k &= 0.01135\end{aligned}$$

time  $t=1802*60/750=144.16$  sec, since flow rate of oxygen is  $750 \text{ m}^3/\text{min}$

$$\begin{aligned}\text{final carbon } C2 &= C1*\exp(-kt) \\ &= 0.239*\exp(-0.01135*144.16) \\ &= 0.0465 \text{ (Actual 0.040)}\end{aligned}$$



-Table 4.17: In Heat No. R1739, T1=1561, C1=0.441, O22=2240, LIM2=0, HL2=217, SVOL=17816, HTR=5.23

$$\begin{aligned}\text{Calculated } k &= -0.000008623*1561+0.0105*0.441-0.0000036*2240-0.000015*217 \\ &\quad -0.0000000091*17816+0.0001678*5.23+0.033548 \\ &= 0.012655\end{aligned}$$

time  $t=2240*60.0/750.0=179.2$  sec, since flow rate of oxygen is  $750 \text{ m}^3/\text{min}$

$$\begin{aligned}\text{final carbon } C2 &= C1*\exp(-kt) \\ &= 0.441*\exp(-0.012655*179.2) \\ &= 0.04566(\text{Actual } 0.430)\end{aligned}$$

-Table 4.18: In Heat No. R1752, C1=0.348, O22=1995, ORE2=460, HL2=238

$$\begin{aligned}\text{Calculated } k &= 0.01368*0.348-0.000002201*1995-0.000001552*460-0.000026113*238 \\ &\quad +0.018160 \\ &= 0.0116\end{aligned}$$

time  $t=1995*60.0/750.0=159.6$  sec, since flow rate of oxygen is  $750 \text{ m}^3/\text{min}$

$$\begin{aligned}\text{final carbon } C2 &= C1*\exp(-kt) \\ &= 0.348*\exp(-0.0116*159.6) \\ &= 0.0546 (\text{Actual } 0.050)\end{aligned}$$

### ***4.3 Results and discussion of end point prediction***

The linear prediction models, which are described in section 4.2, are used to predict the end point, given all the parameters of the blow.

#### ***4.3.1 End point carbon prediction***

When we plot error in carbon prediction versus actual carbon for the dataset D3, which is shown in Fig 4.1, we find that errors become higher, as the actual carbon wt% increases. We observed that errors become unacceptable above 0.060% actual carbon. This can be ascribed due to nonlinear nature of the process. In the dataset D1, almost all the heats were below 0.060% carbon, thus the linear equations developed are valid in that range

only. If we want to predict carbon in higher range, we should develop separate models with the help of adequate data. Thus we conclude that our predictions are valid in the range below 0.060% final carbon.

The actual versus predicted carbon graphs are given in Figs 4.2-4.5 for the four datasets. Table 4.19 gives the average and RMS deviations of predicted carbon from actual carbon for the heats below 0.060% final carbon.

It is observed from Table 4.19 we observe that as we proceed from D1 to D4, the error in prediction keeps on increasing. We can thus say that as we go along heats, the changes in converter and lance conditions are such that the effective equation for predicting carbon keeps on changing and a stationary linear model can not give good results over long time.

#### ***4.3.1.1 Comparison of linear and exponential model for end point carbon prediction***

It was found in earlier work [1] that linear prediction models for carbon perform better than non-linear prediction models in a small range of operating variables. We also tried an exponential model for carbon in which a linear prediction equation for capacity mass transfer coefficient of carbon is developed. The summary of these exponential models for different group of heats of dataset D1 is given in Tables 4.16-4.18. The predicted carbon using exponential models versus actual carbon for the dataset D1 is shown in Fig 4.6. The predicted carbon using linear models versus actual carbon for the dataset D1 is shown in Fig 4.2. We see much less scattering in the Fig 4.2 than in Fig 4.6. Also, RMS error in prediction for exponential models on dataset D1 is 0.0063 wt%, while RMS error in prediction for linear models on dataset D1 is 0.0054%. Thus we see that even for the dataset used in present work the linear prediction models give better results than exponential models in this carbon range (where carbon is less than 0.060 wt%).

### ***4.3.2 End point temperature prediction***

Figure 4.7 shows actual versus predicted end point carbon for dataset D1. Table 4.20 lists the deviations of predicted temperature from actual temperature for the datasets D1, D2, D3 and D4. It is evident from Fig 4.7 that predictions of temperature for the dataset D1 are satisfactory. Also we see from Table 4.20 that the error in prediction in temperature keeps on increasing as we go from D1 to D4. When. Figures 4.8-4.10 show error in temperature prediction versus serial number of heat for datasets D1, D2 and D3, respectively. From these figures we observe that as the serial number increases, the actual temperature becomes lower and lower than the predicted temperature. This phenomenon can be attributed to refractory erosion. This can be corrected if we apply time series analysis to correct the periodic errors. Another solution is to incorporate the most recent heats only in the linear regression. We have tried the latter in the next section on sequential linear regression models.

### ***4.3.3 End point manganese prediction***

Plots of predicted versus actual manganese are shown in Figs 4.11-4.14. Table 4.21 lists the deviations of predicted manganese from actual manganese for the four datasets. It is evident from the Table 4.21 that error in prediction increases as we go from dataset D1 to dataset D4. This again confirms the conclusion that conditions of converter keep on changing with time and it is not possible to get good prediction using a single set of linear prediction equation for all heats. In Figs 4.13-4.14, for most of the heats predicted manganese is higher than the actual value. Thus, it can be said that changes in converter profile shifts the predictions in a particular direction and not randomly.

### ***4.3.4 End point phosphorus prediction***

Plots of predicted versus actual phosphorus are shown in Figs 4.15-4.18. Table 4.22 lists the deviations of predicted manganese from actual manganese for the four datasets. The same trend as observed in the case of carbon, temperature and manganese, is also observed with phosphorus. The error in prediction of phosphorus increases as we move

from D1 to D4. For dataset D3, most of heats have higher predicted phosphorus than actual phosphorus and in dataset D4, all the heats have higher predicted phosphorus than actual phosphorus. Thus, in phosphorus prediction also we see a gradual shift in error of prediction in one direction.

#### ***4.3.5 End point dissolved oxygen prediction***

Plots of predicted versus actual dissolved oxygen are shown in Figs 4.19-4.22. Table 4.23 lists the deviations of predicted manganese from actual manganese for the four datasets. We see quite a lot of scatter even in prediction for the dataset D1. Also the error in prediction increases to unacceptable limits as we move from dataset D1 to dataset D4. In dataset D4, for all the heats the predicted dissolved oxygen is much higher than the actual value.

Thus, we see that in end point predictions, there is a gradual shift in error of prediction in one direction as we proceed from dataset D1 to dataset D4 (increasing campaign life). This gradual shift can be attributed to the changing converter and lance conditions. We can thus conclude that a single linear prediction model cannot give good predictions for a large number of heats and changing converter and lance conditions must be incorporated in the model as we proceed in time.

#### ***4.4 Sequential linear regression models***

As we have seen in the previous section that converter conditions keep on changing continuously and the linear equation should be modified with these changing conditions for good end point predictions. An effective way is to keep on adding the data of new heats and deleting the data of oldest heats from the data file by which we develop regression equations. We did updating of the data file in the batches of 60. In doing these linear regressions, we did not consider LIME2, DOLO2 and RSL2 as variables, as these

Table 4.19 Deviation of predicted carbon (wt%) from actual carbon using linear prediction equations from Tables 4.1-4.3

Data set	D1	D2	D3	D4
Average deviation	0.004344	0.004839	0.005173	0.008606
RMS deviation	0.005393	0.006266	0.006341	0.010620

Table 4.20 Deviation of predicted temperature ( $^{\circ}\text{K}$ ) from actual temperature using linear prediction equations from Tables 4.4-4.6

Data set	D1	D2	D3	D4
Average deviation	5.68	7.53	7.08	11.64
RMS deviation	7.28	9.51	9.38	14.25

Table 4.21 Deviation of predicted manganese (wt%) from actual manganese using linear prediction equations from Tables 4.7-4.9

Data set	D1	D2	D3	D4
Average deviation	0.01172	0.0151	0.0182	0.0404
RMS deviation	0.01438	0.0196	0.0260	0.0492

Table 4.22 Deviation of predicted phosphorus (wt%) from actual phosphorus using linear prediction equations from Tables 4.10-4.12

Data set	D1	D2	D3	D4
Average deviation	0.00157	0.00218	0.00349	0.00583
RMS deviation	0.001987	0.00280	0.00452	0.00646

Table 4.23 Deviation of predicted dissolved oxygen (ppm) from actual dissolved oxygen using linear prediction equations from Tables 4.13-4.15

Data set	D1	D2	D3	D4
Average deviation	154.37	238.25	201.83	368.56
RMS deviation	186.83	301.57	241.41	382.62

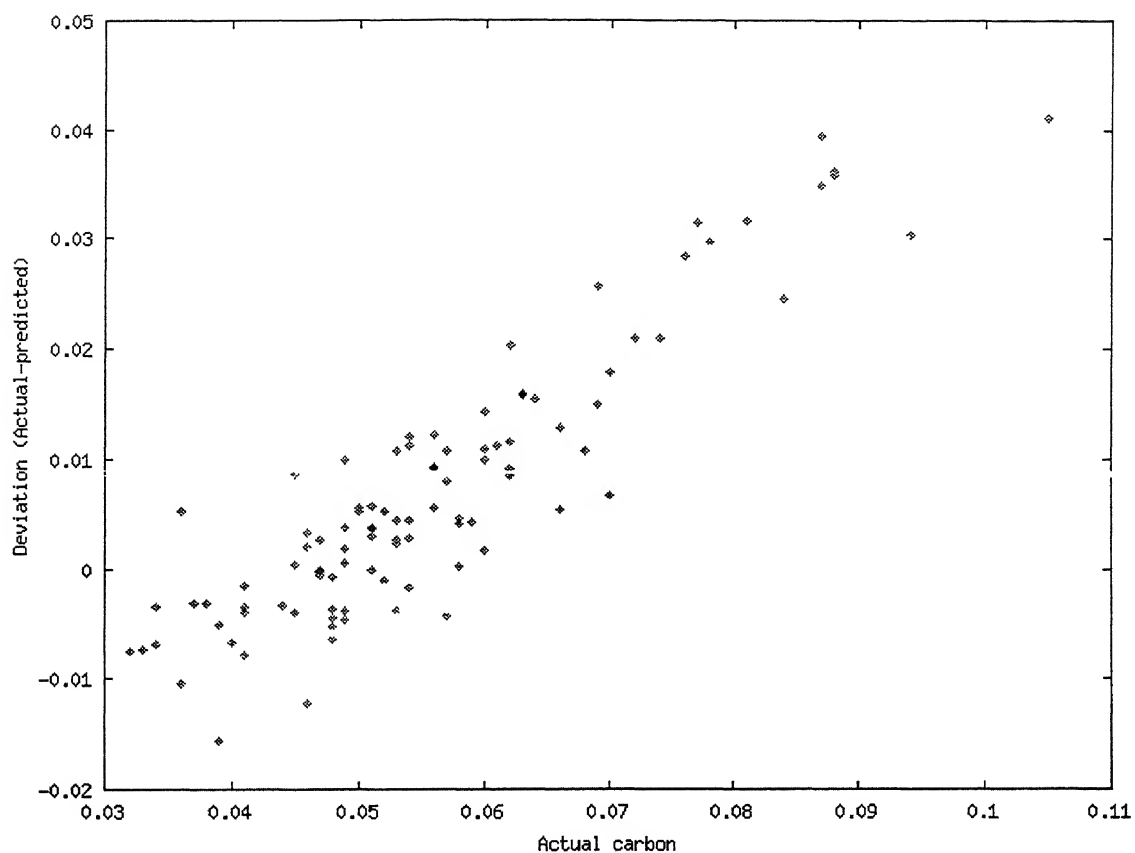


Fig 4.1 Deviation (actual-predicted) in carbon wt% versus actual carbon wt% for dataset D3 using linear prediction equations from Tables 4.1-4.3

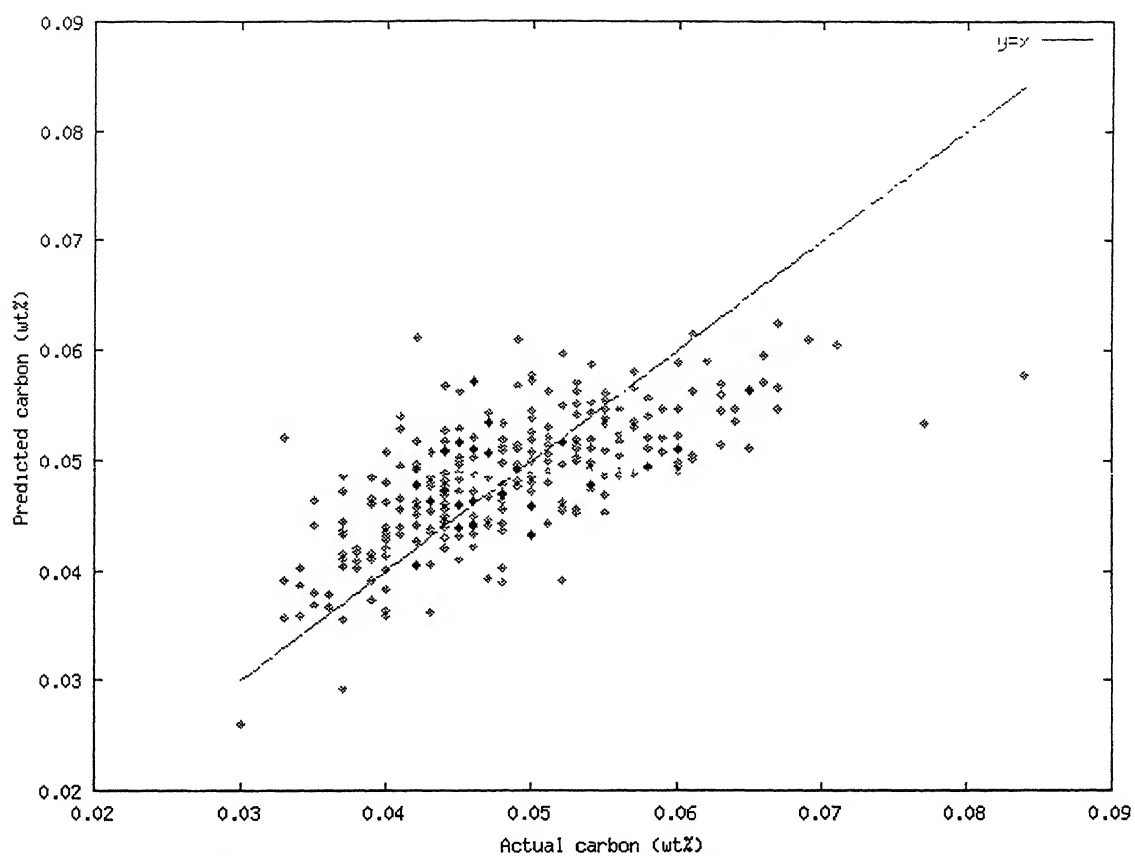


Fig 4.2 Predicted carbon versus actual carbon in wt% for dataset D1 using linear prediction equations from Tables 4.1-4.3

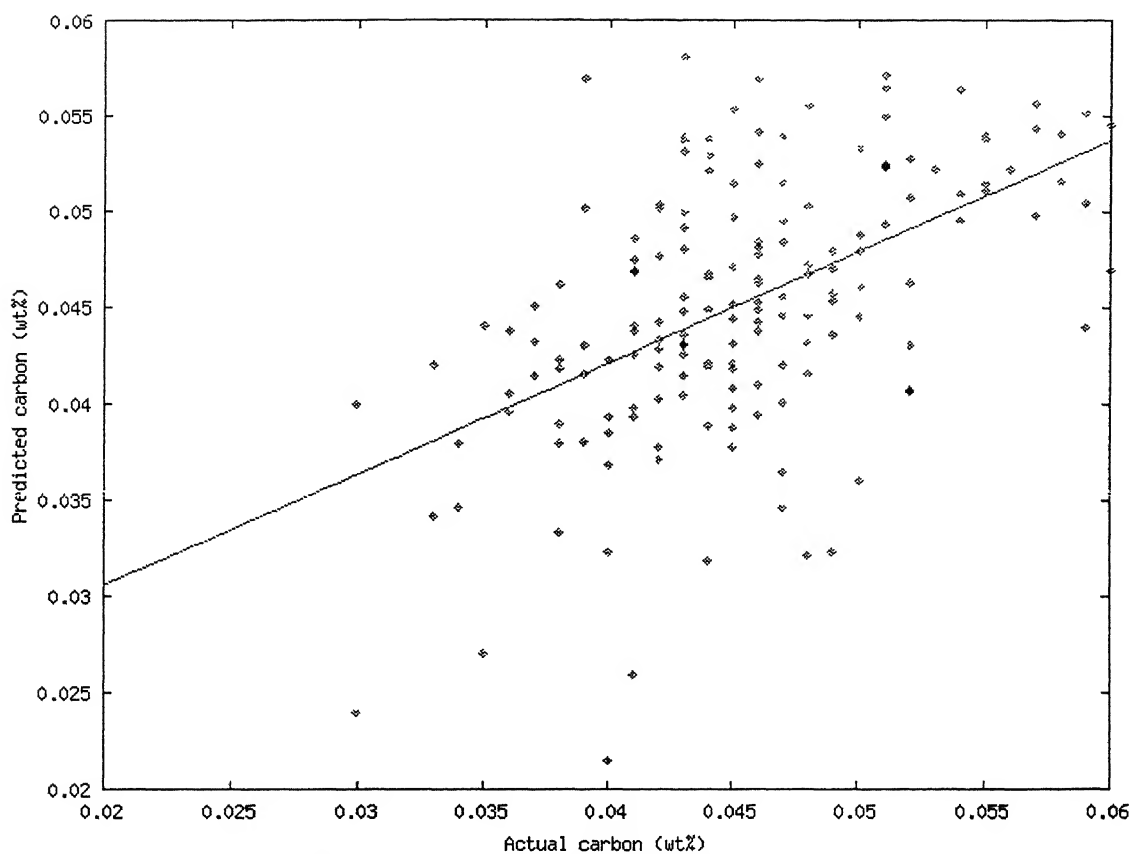


Fig 4.3 Predicted carbon versus actual carbon in wt% for dataset D2 using linear prediction equations from Tables 4.1-4.3



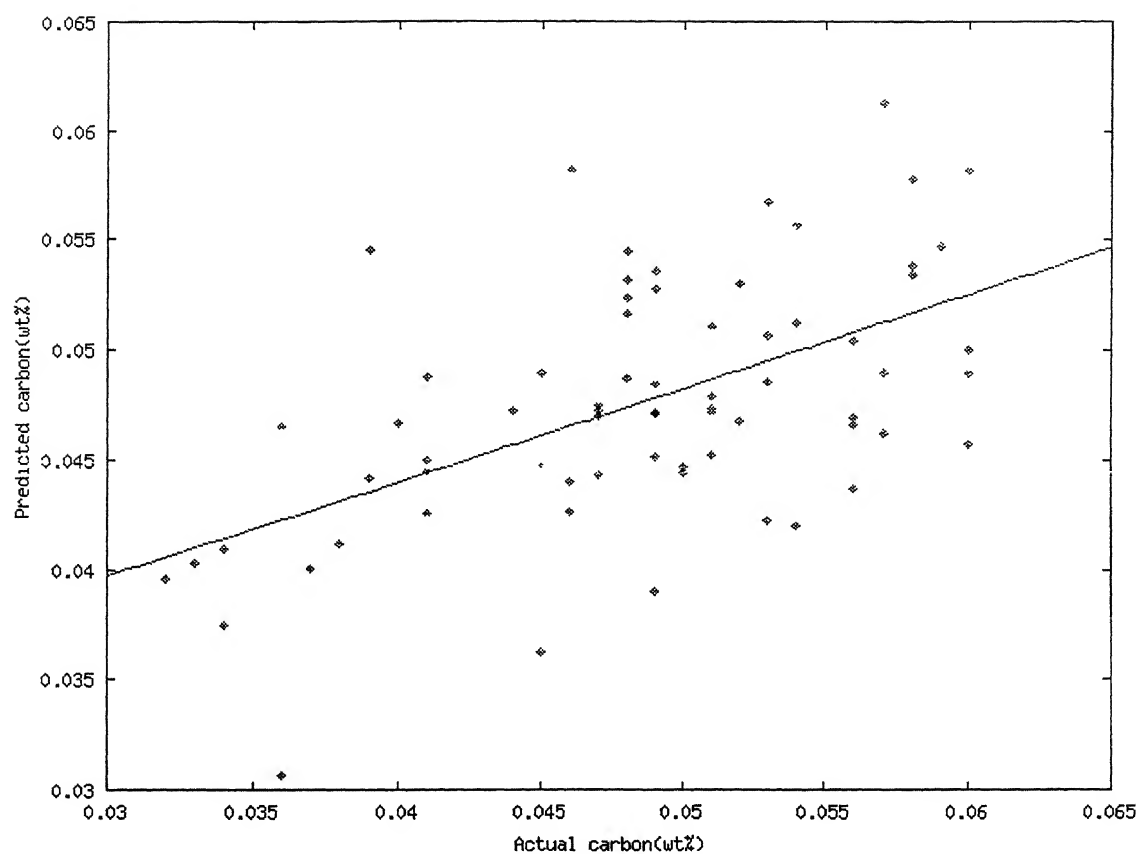


Fig 4.4 Predicted carbon versus actual carbon in wt% for dataset D3 using linear prediction equations from Tables 4.1-4.3

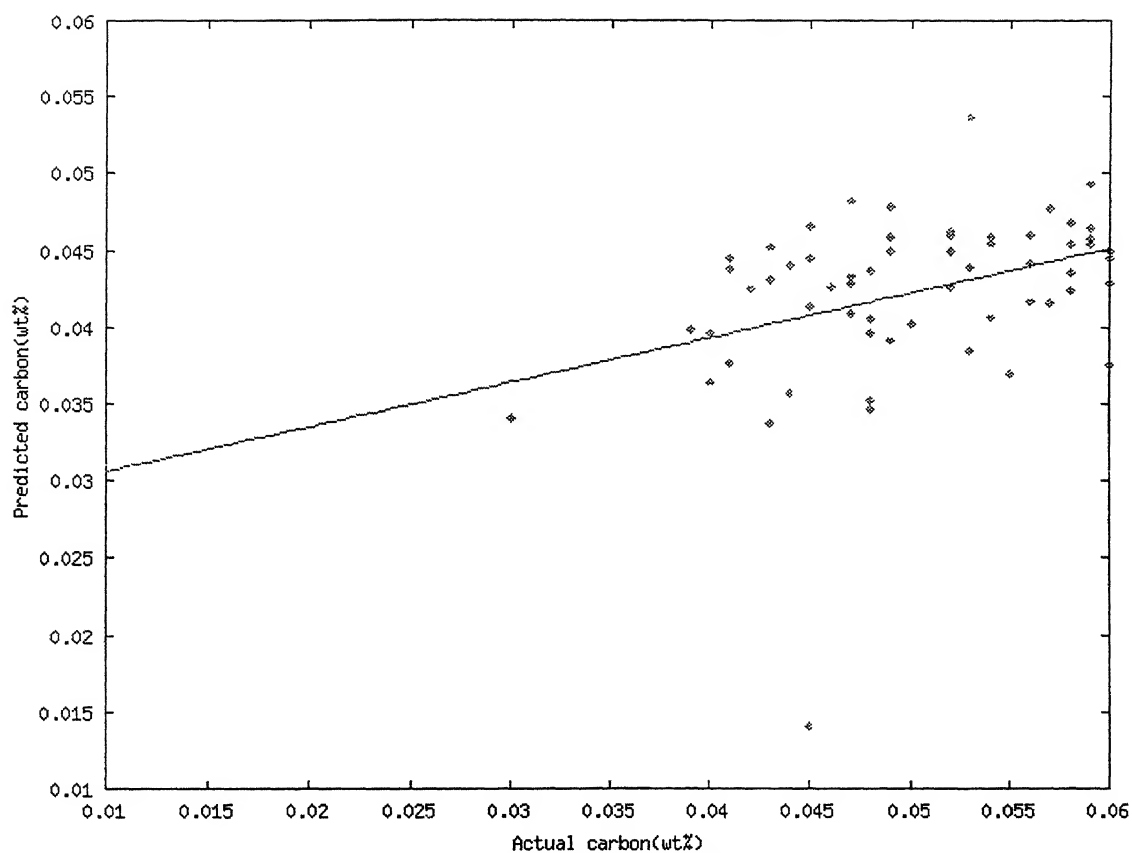


Fig 4.5 Predicted carbon versus actual carbon in wt% for dataset D4 using linear prediction equations from Tables 4.1-4.3

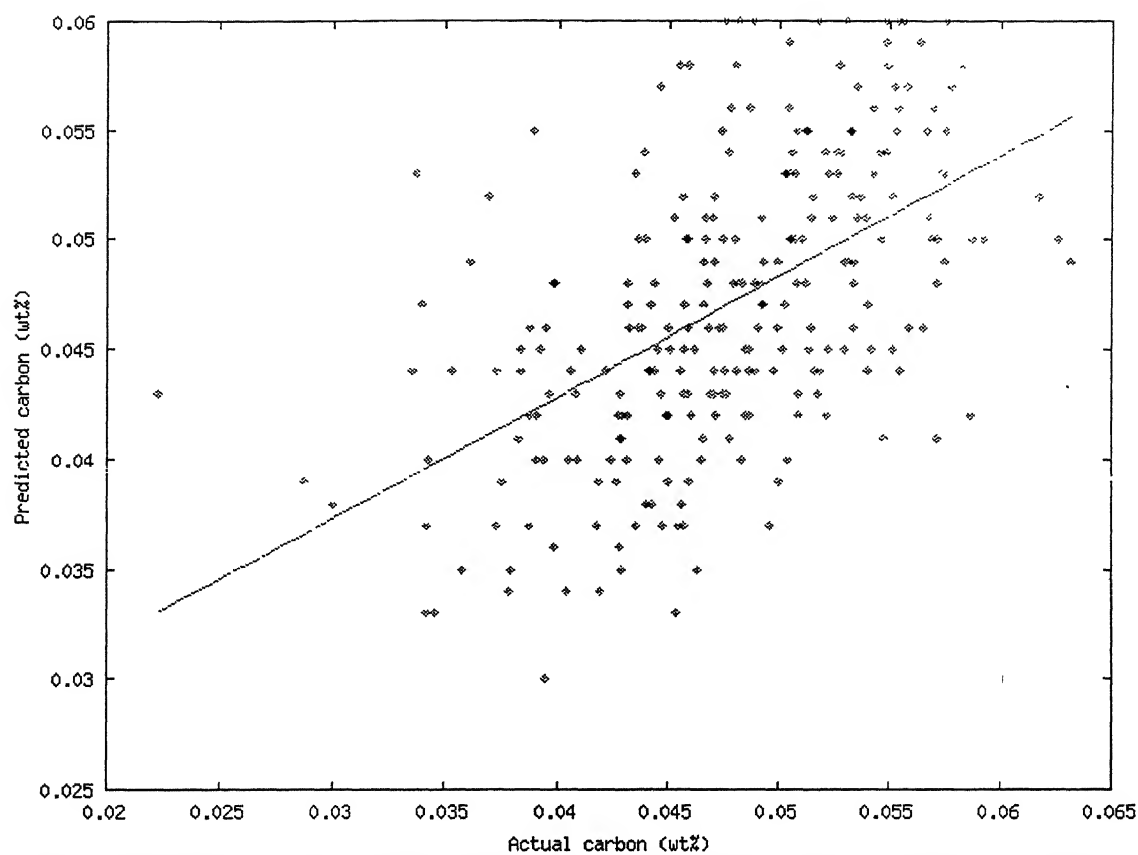


Fig 4.6 Predicted versus actual carbon using exponential models described in Tables 4.16-4.18

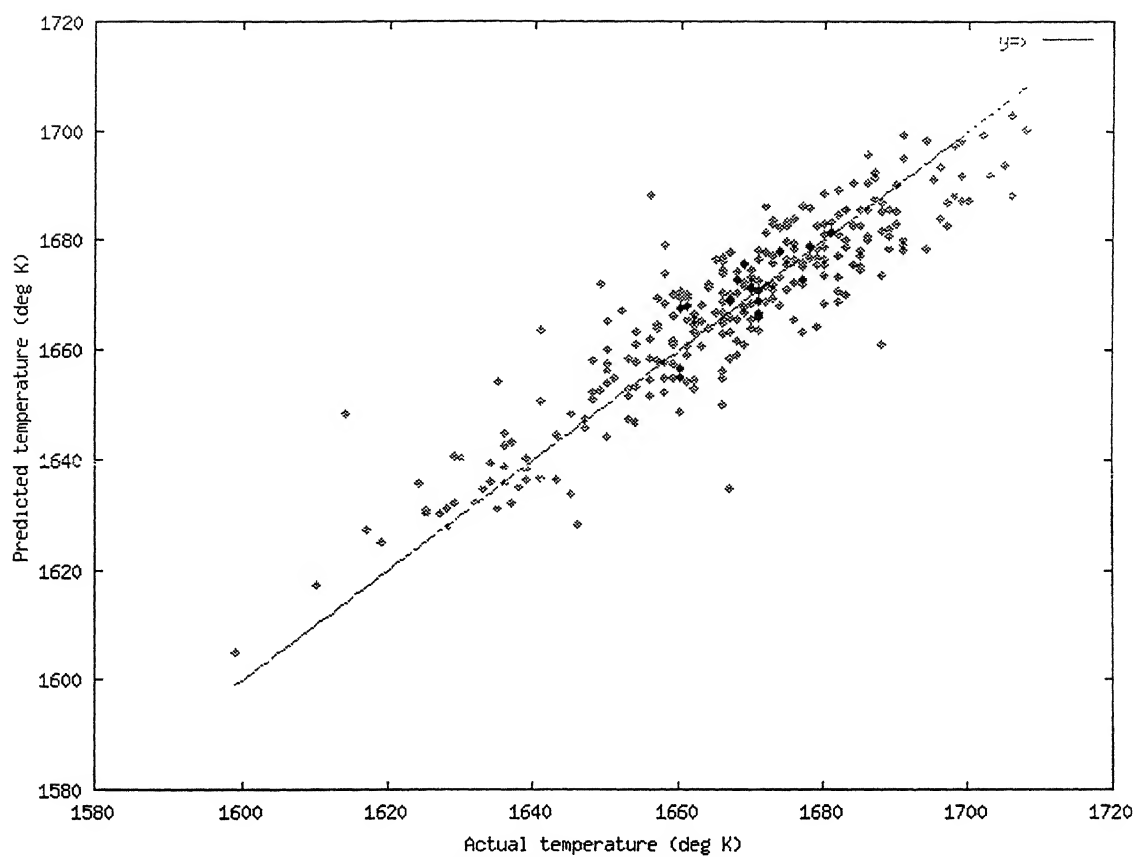


Fig 4.7 Predicted versus actual temperature for dataset D1 using linear prediction equations from Tables 4.4-4.6

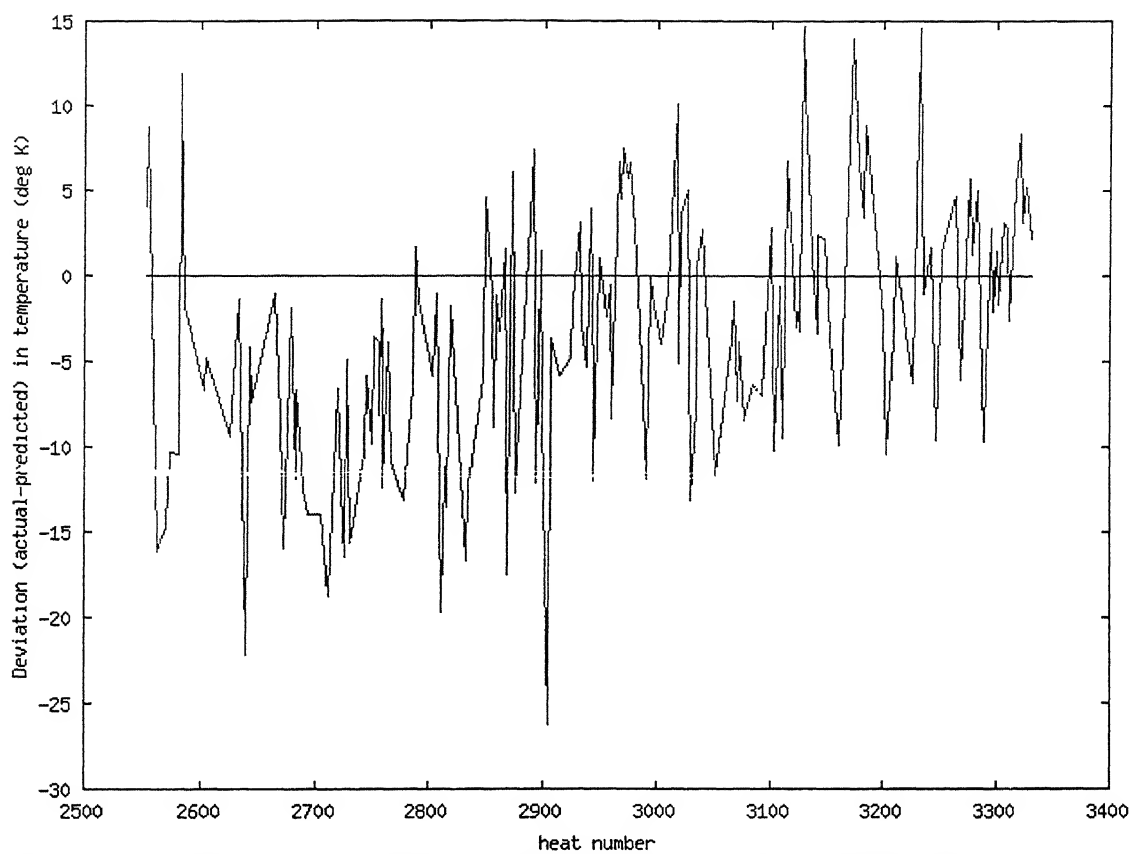


Fig 4.8 Deviation (actual-predicted) versus heat number for dataset D2 using linear prediction equations from Tables 4.4-4.6

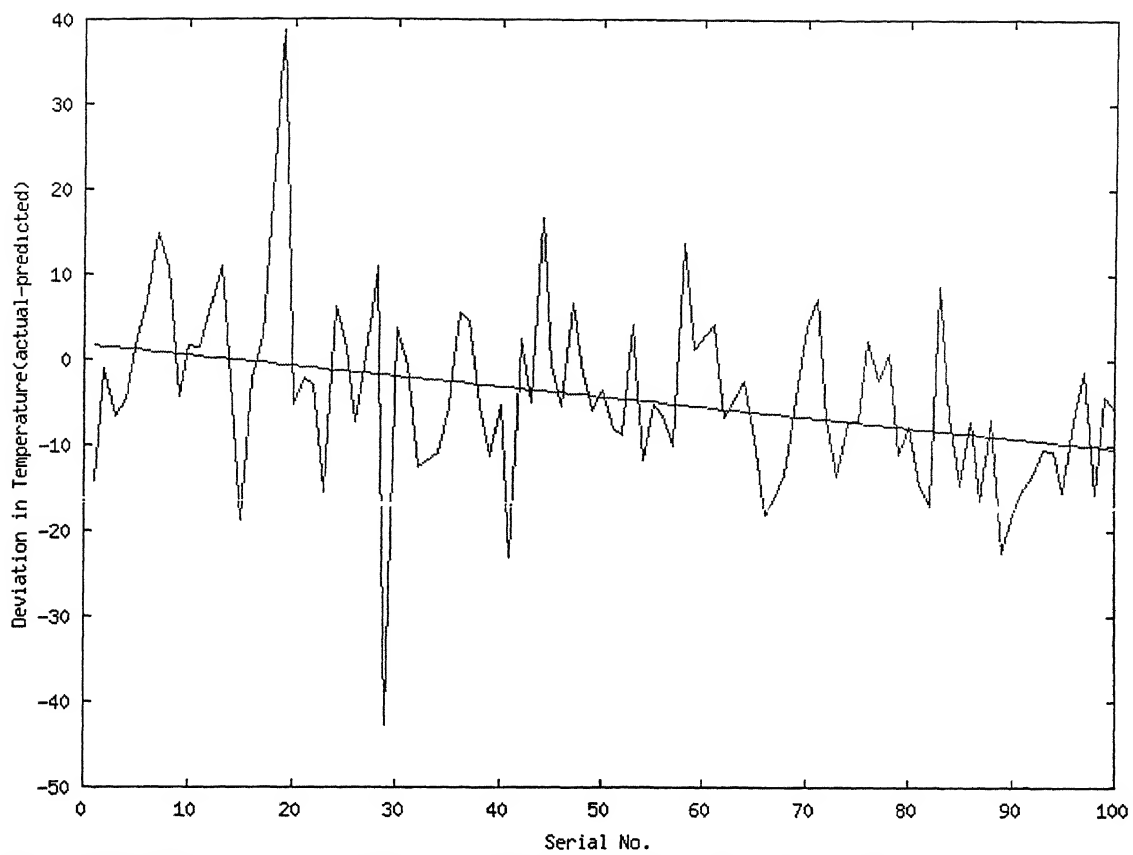


Fig 4.9 Deviation (actual-predicted) versus heat number for dataset D2 using linear prediction equations from Tables 4.4-4.6

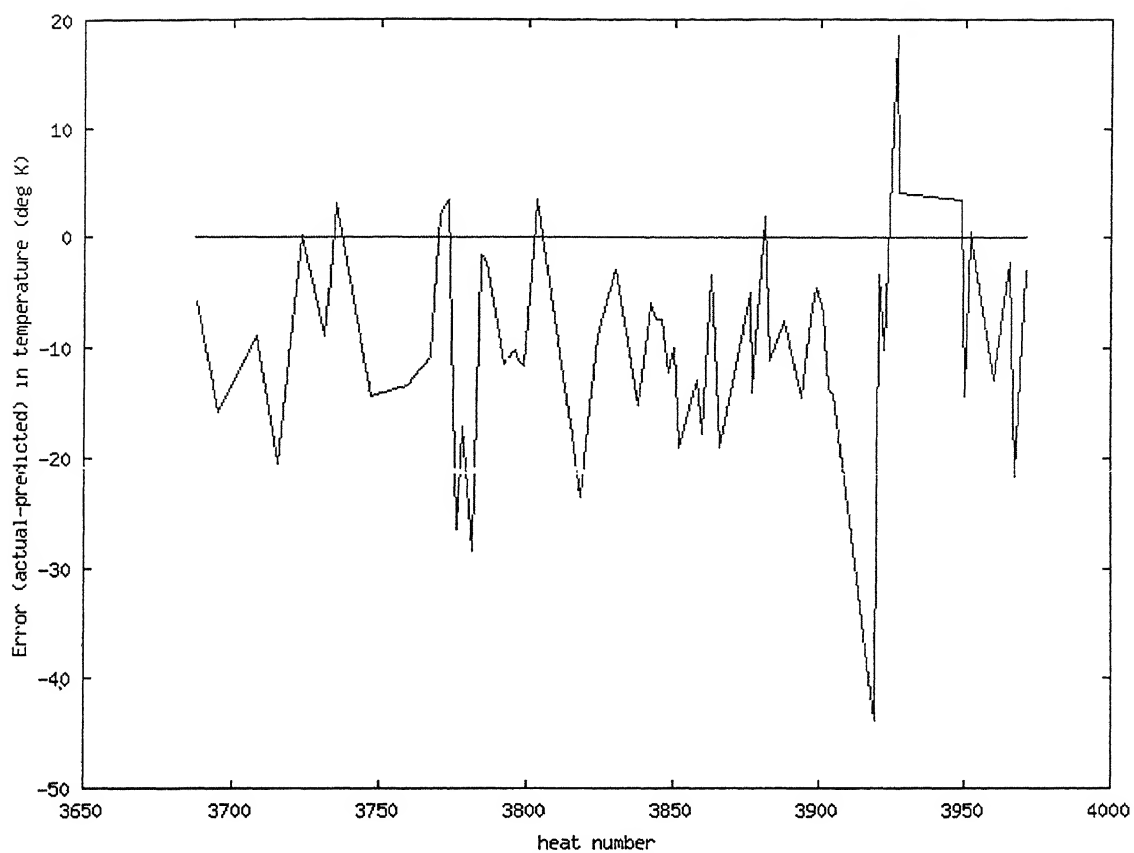


Fig 4.10 Deviation (actual-predicted) versus heat number for dataset D4 using linear prediction equations from Tables 4.4-4.6

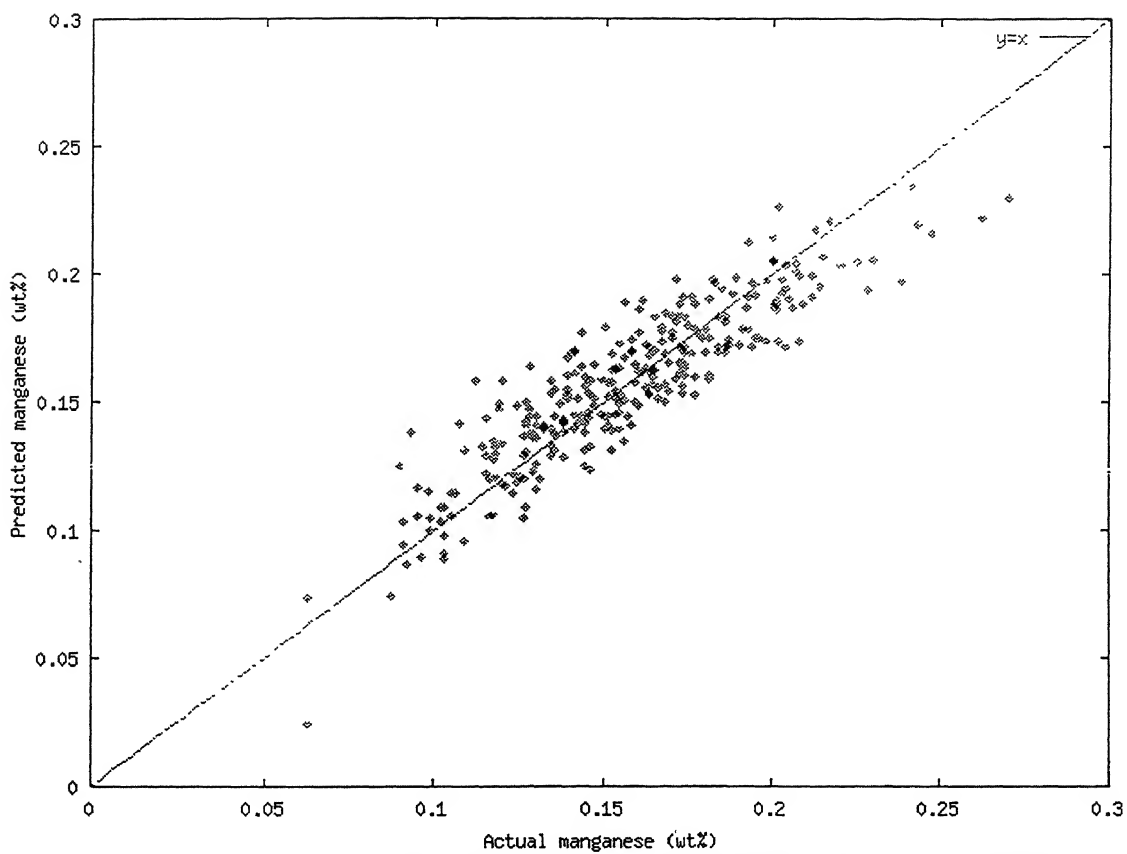


Fig 4.11 Predicted versus actual manganese for dataset D1 using linear prediction equations from Tables 4.7-4.9



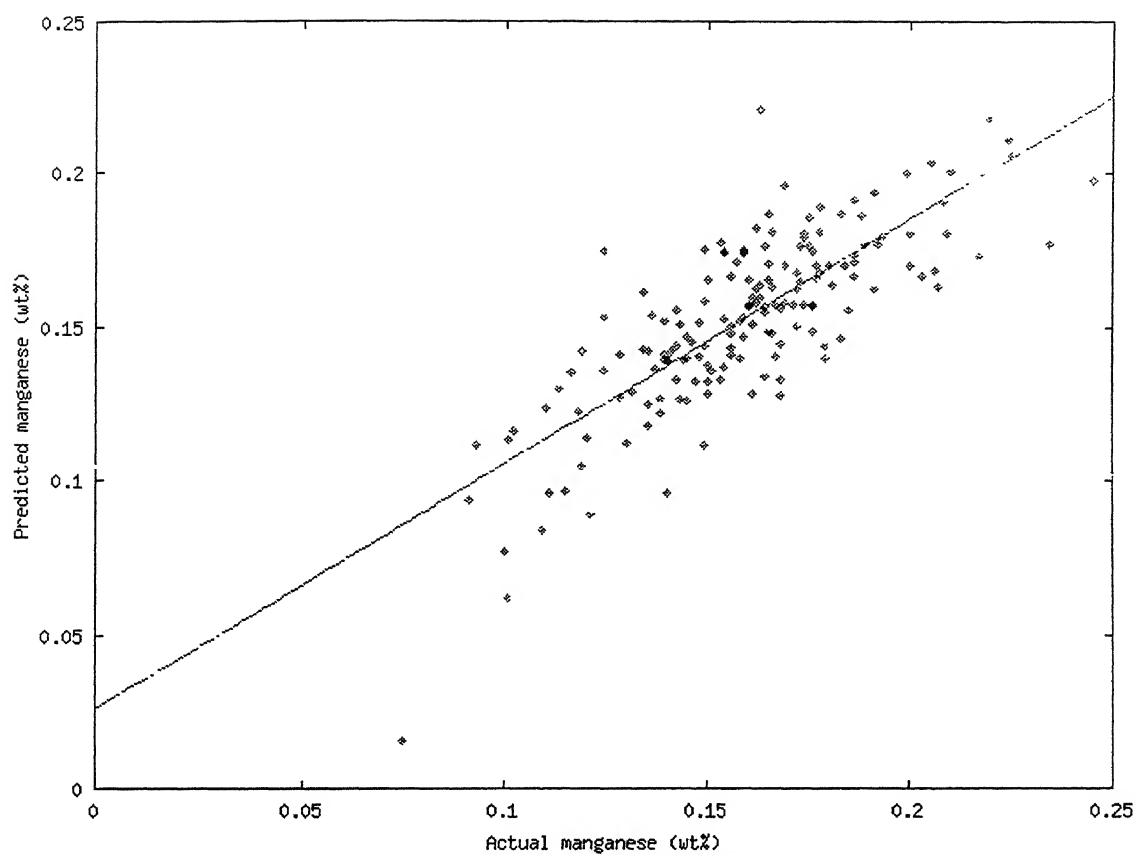


Fig 4.12 Predicted versus actual manganese for dataset D2 using linear prediction equations from Tables 4.7-4.9

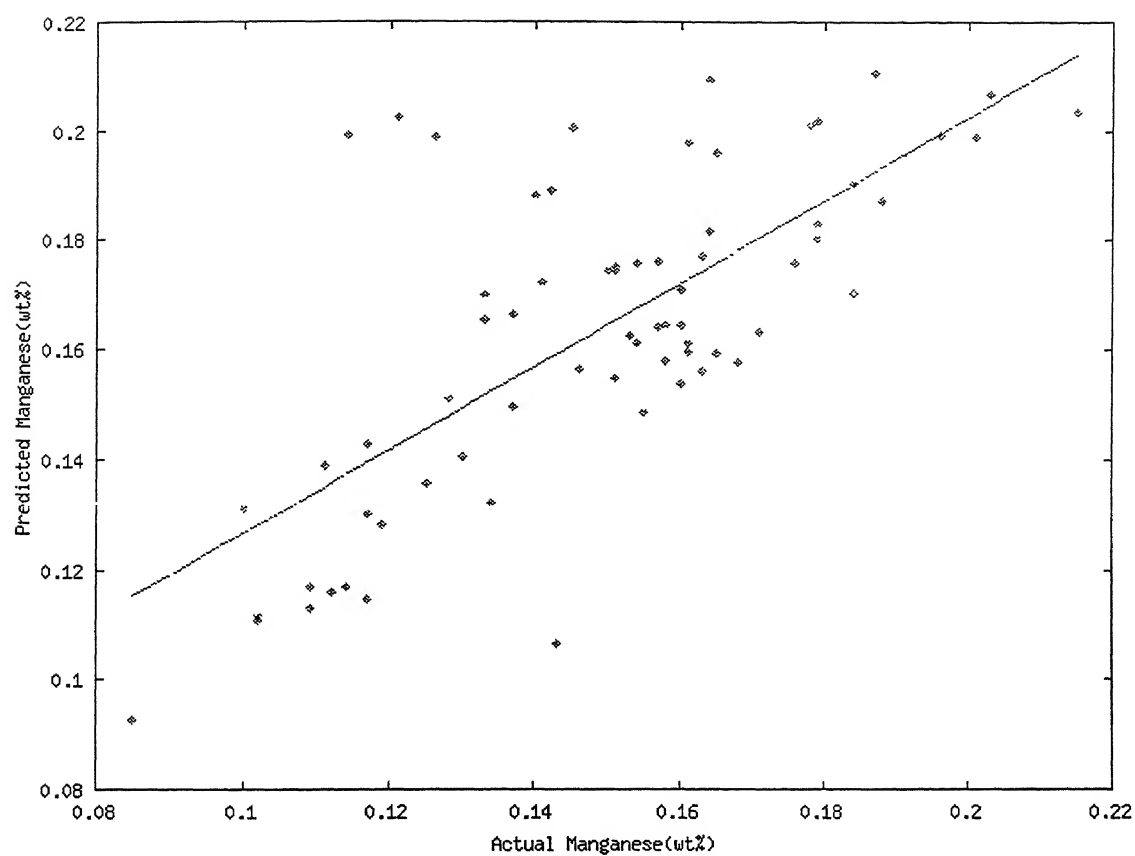


Fig 4.13 Predicted versus actual manganese for dataset D3 using linear prediction equations from Tables 4.7-4.9

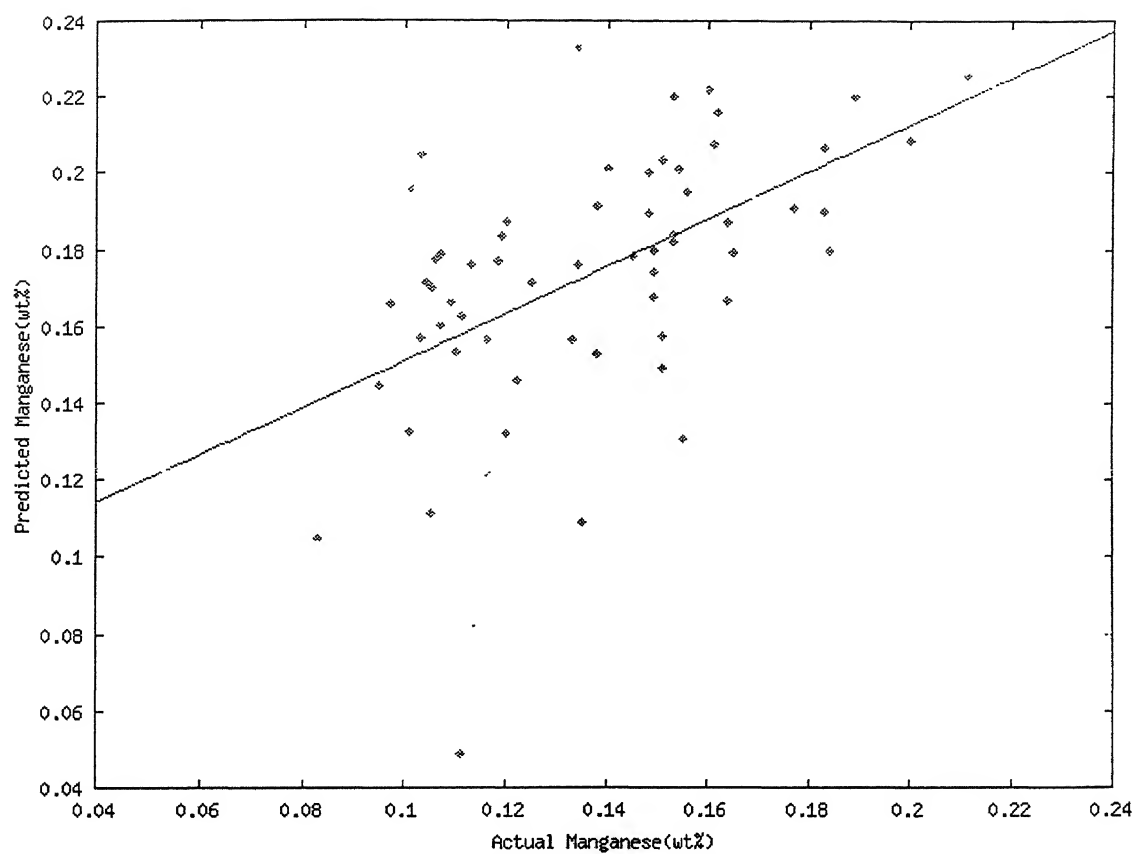


Fig 4.14 Predicted versus actual manganese for dataset D4 using linear prediction equations from Tables 4.7-4.9

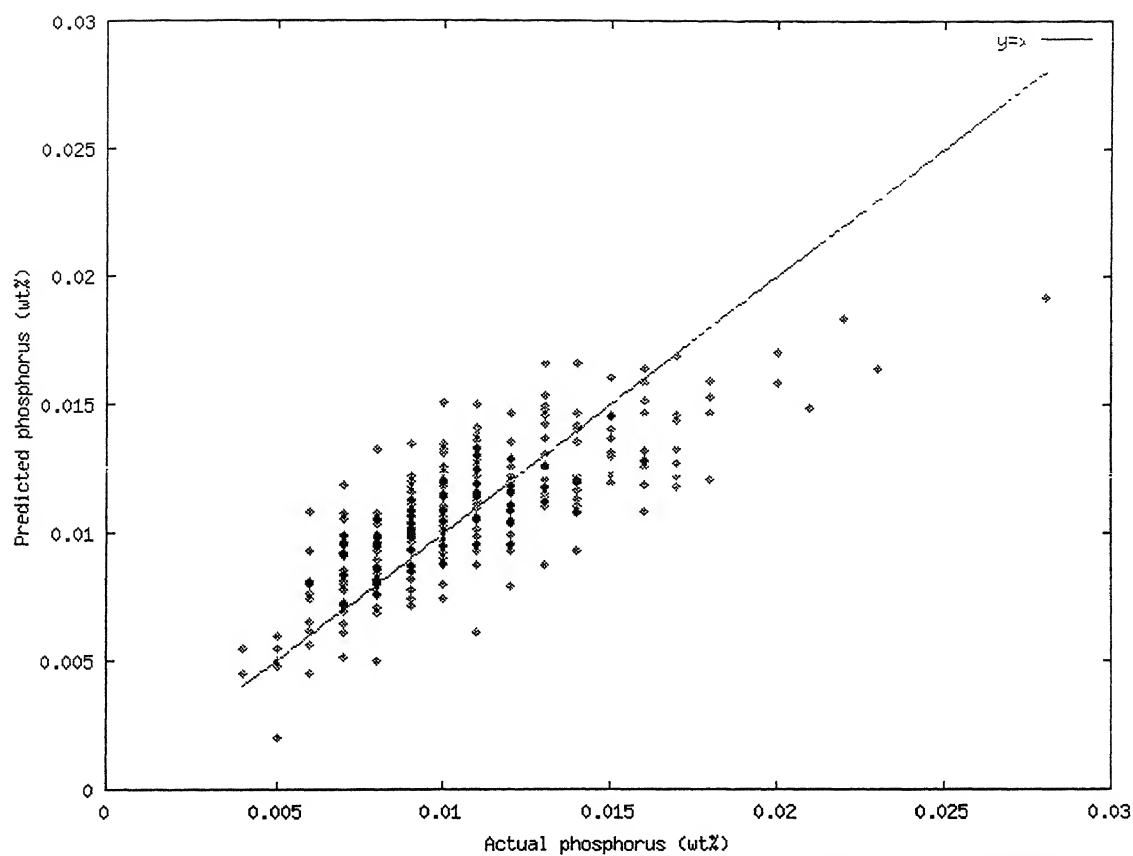


Fig 4.15 Predicted versus actual phosphorus for dataset D1 using linear prediction equations from Tables 4.10-4.12

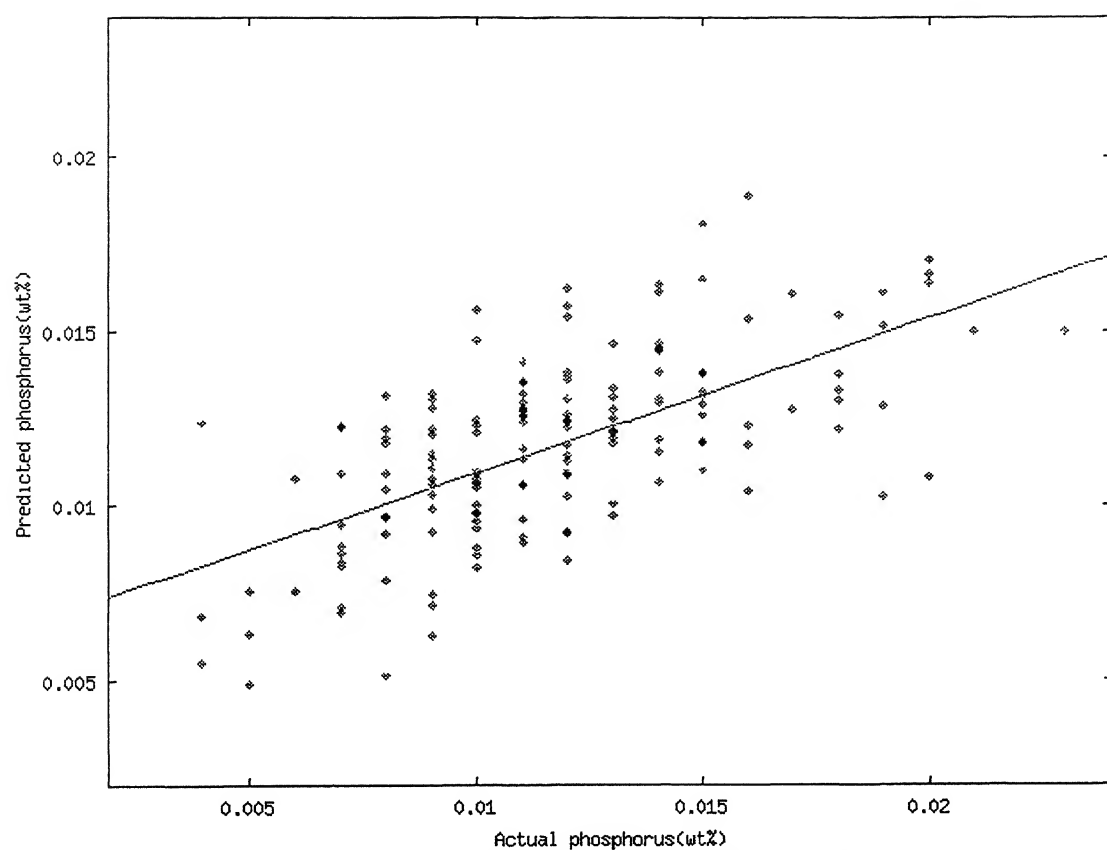


Fig 4.16 Predicted versus actual phosphorus for dataset D2 using linear prediction equations from Tables 4.10-4.12

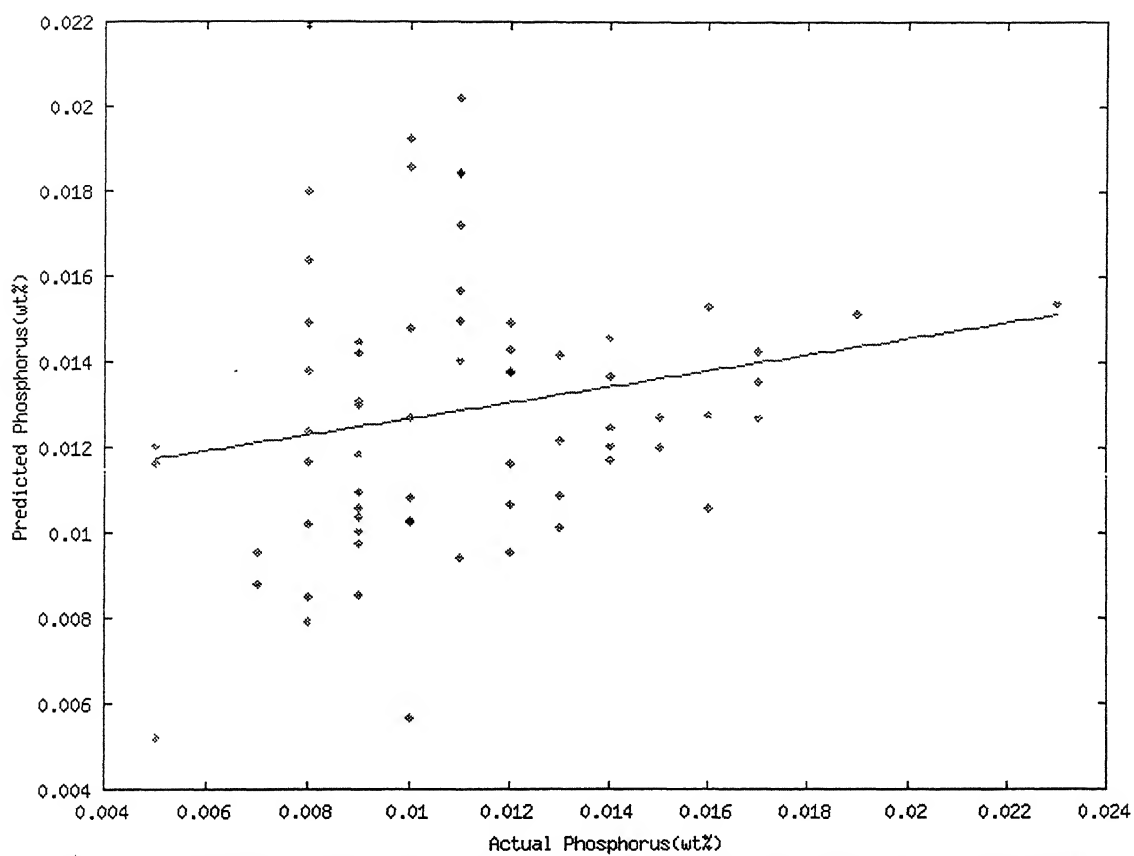


Fig 4.17 Predicted versus actual phosphorus for dataset D3 using linear prediction equations from Tables 4.10-4.12

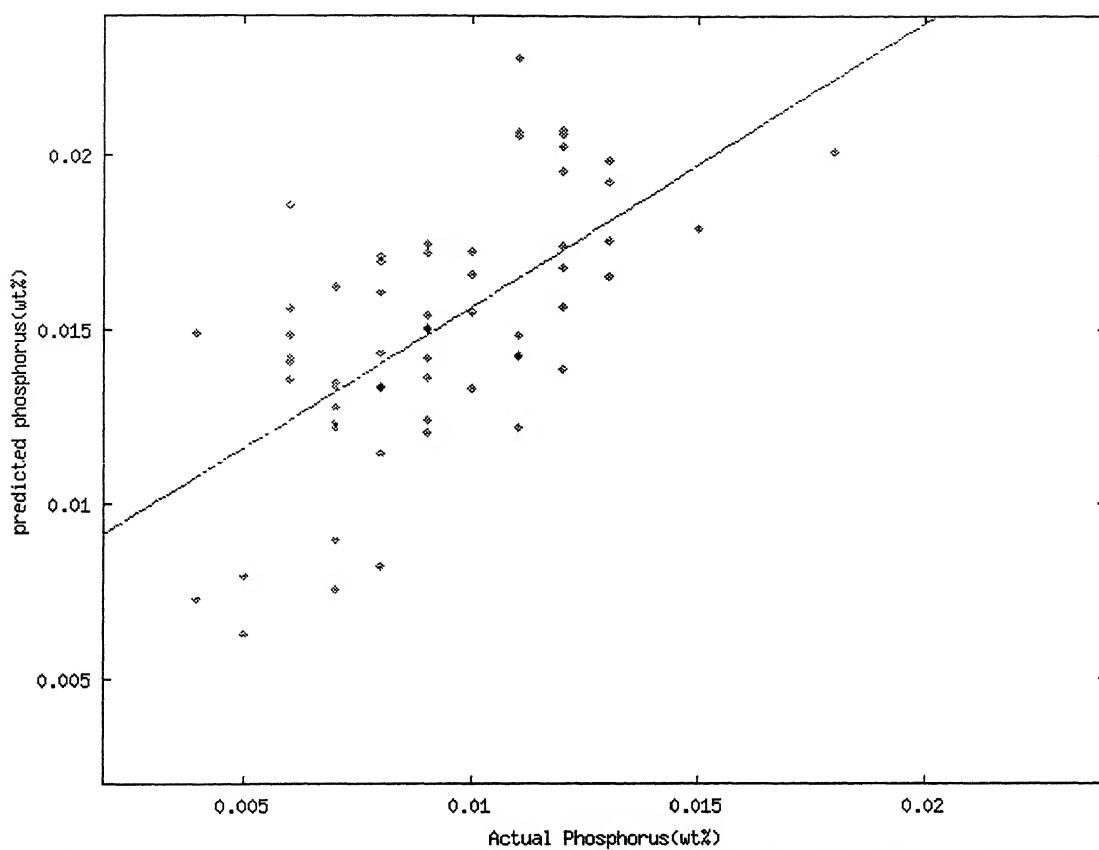


Fig 4.18 Predicted versus actual phosphorus for dataset D4 using linear prediction equations from Tables 4.10-4.12

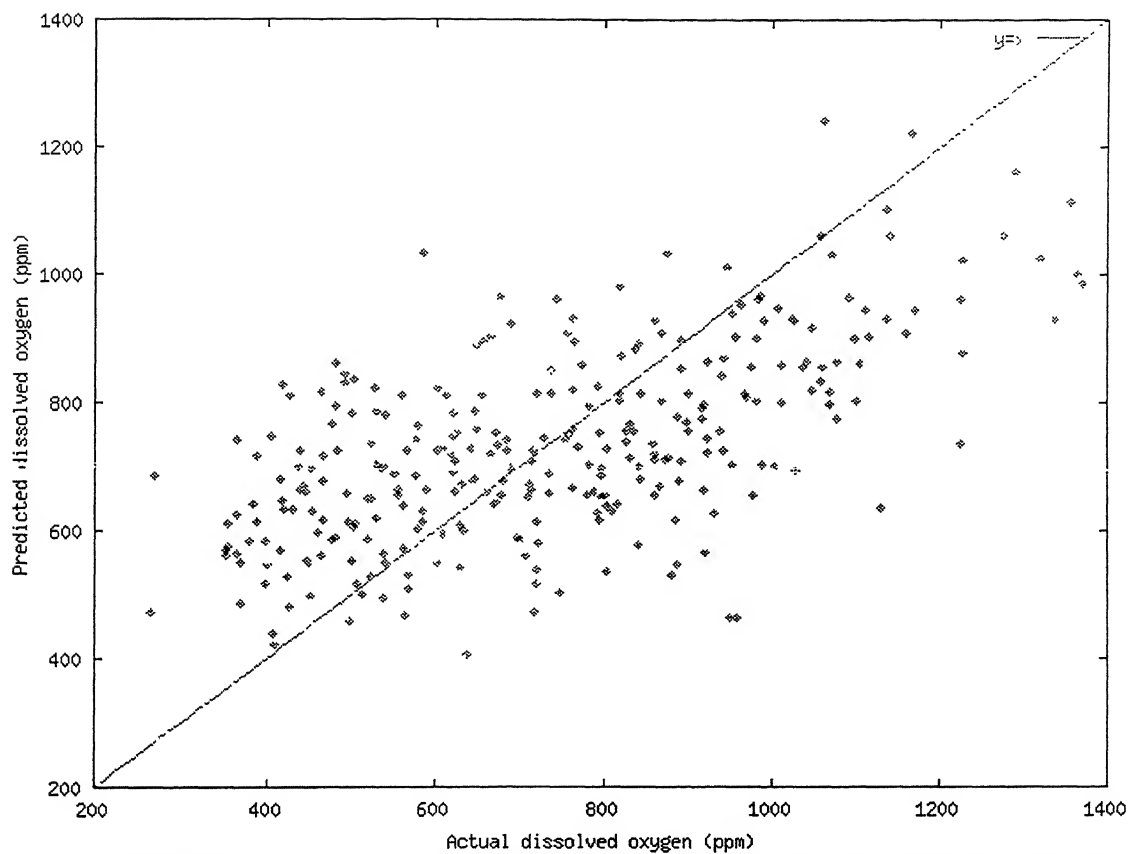


Fig 4.19 Predicted versus actual dissolved oxygen for dataset D1 using linear prediction equations from Tables 4.13-4.15



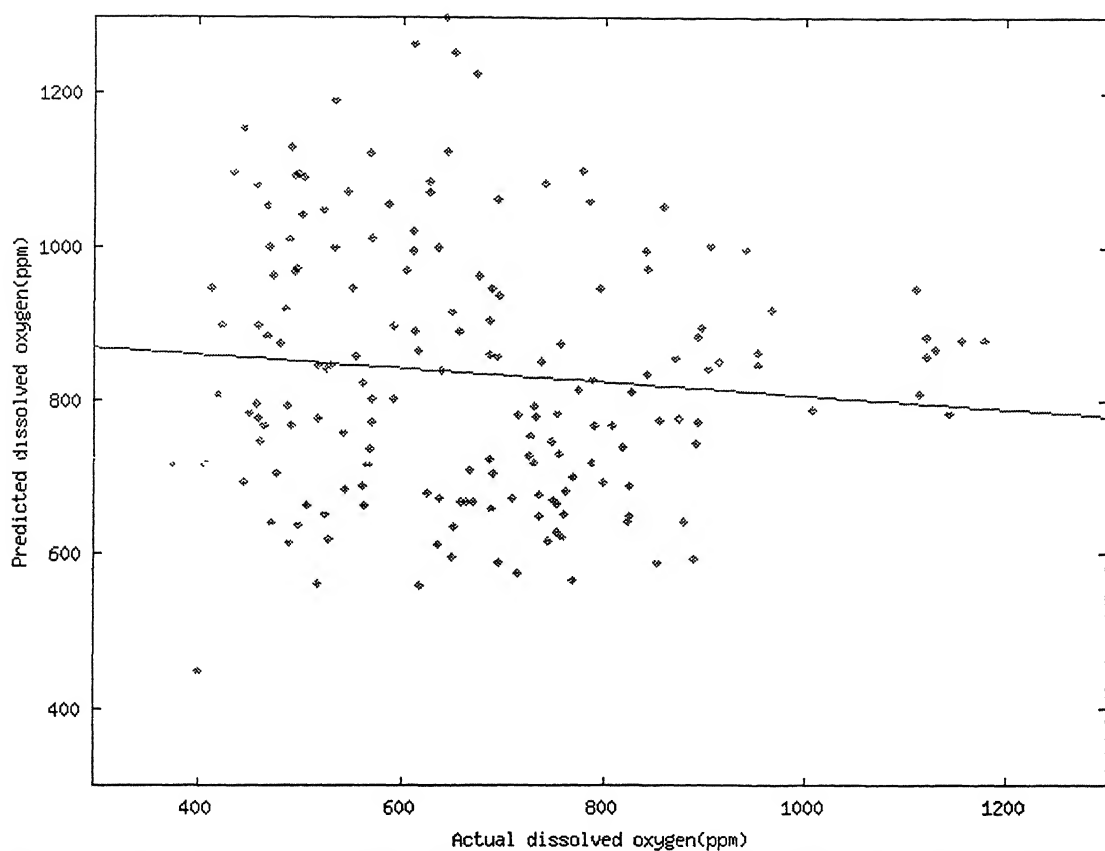


Fig 4.20 Predicted versus actual dissolved oxygen for dataset D2 using linear prediction equations from Tables 4.13-4.15

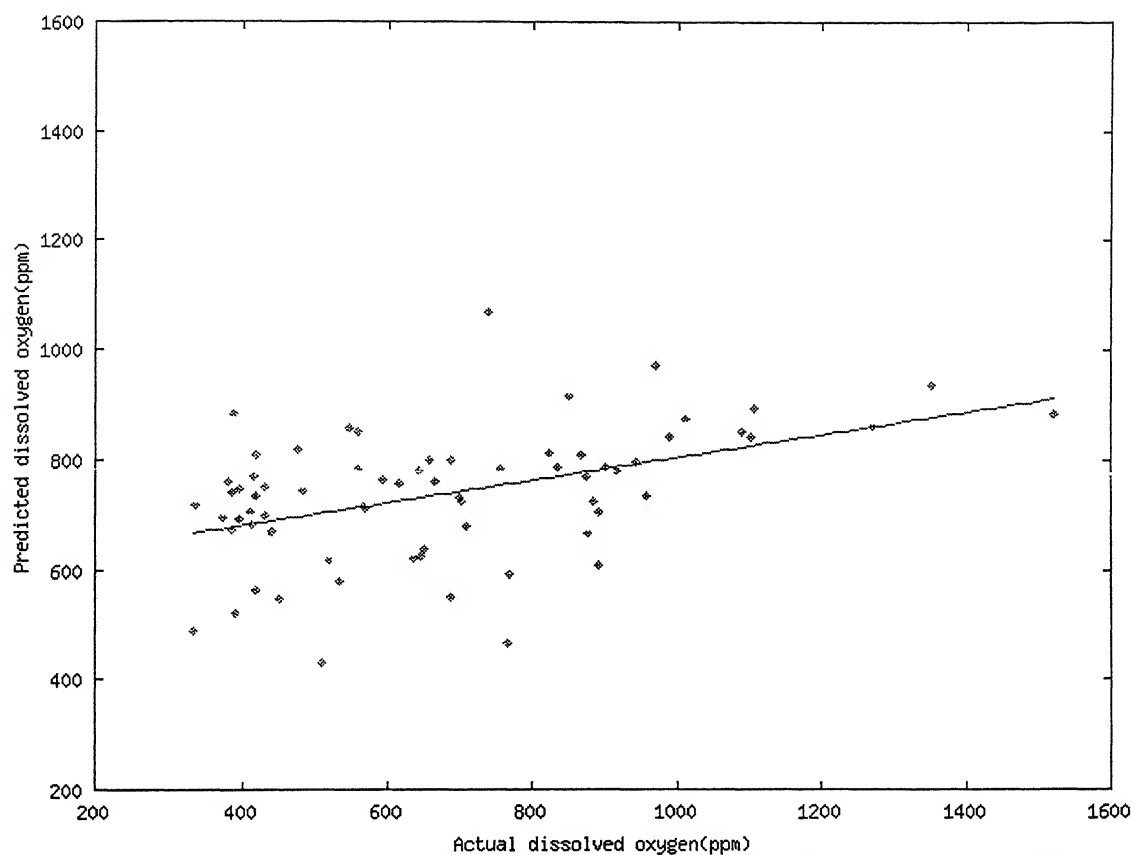


Fig 4.21 Predicted versus actual dissolved oxygen for dataset D3 using linear prediction equations from Tables 4.13-4.15

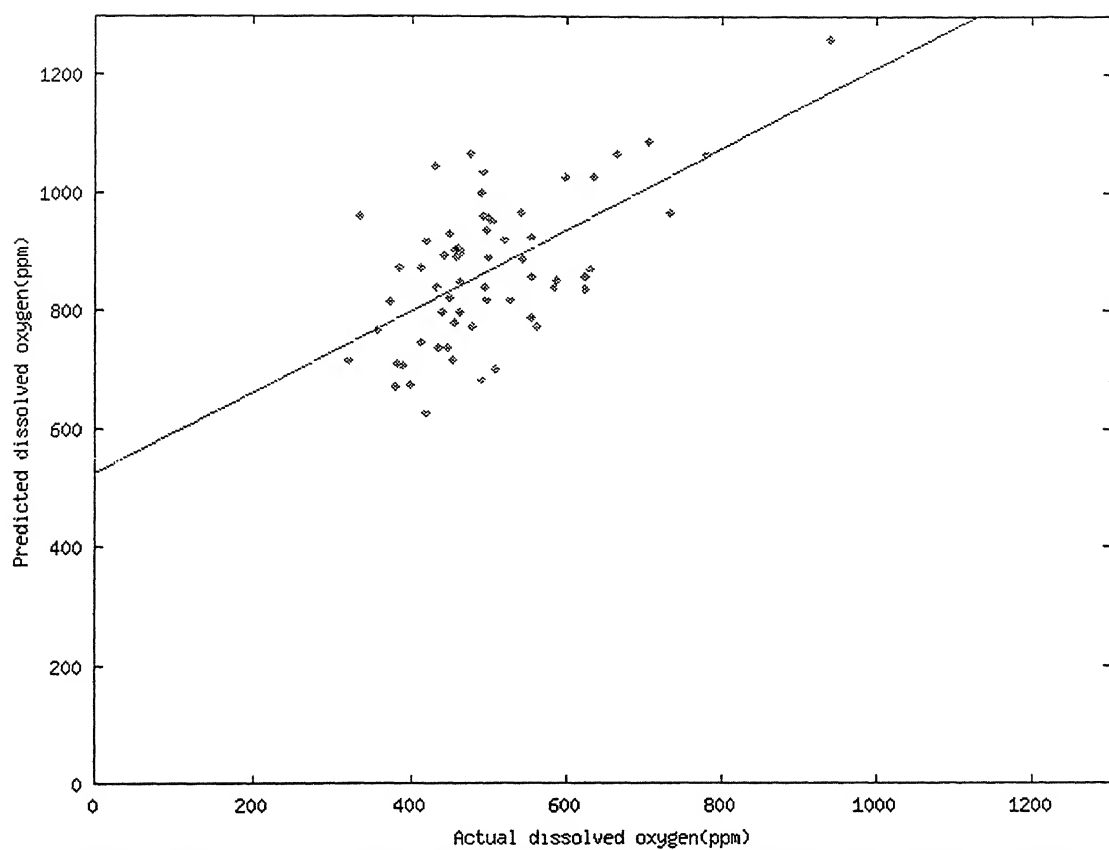


Fig 4.22 Predicted versus actual dissolved oxygen for dataset D4 using linear prediction equations from Tables 4.13-4.15

are zero for most of the heats in datasets D2, D3, D4. We used their old coefficient to incorporate them in linear prediction models. Table 4.18 gives the heats included in each run.

Coefficients of various terms obtained in these linear regression runs are presented in Tables 4.19-4.33. In these regression runs we included only those heats in which final carbon was less than 0.060 wt% and ORE2 and RDOLO2 were not added together. Average and RMS errors in prediction using these sequential linear prediction models for the different datasets are given in Tables 4.19 to 4.23.

#### ***4.4.1 Comparison of sequential and static linear prediction models***

Static linear prediction model is the model in which the linear equation once developed is used for all heats whereas in sequential linear regression, we keep on updating the data file for regression and the equations keep on changing as we proceed in time. Tables 4.19-4.23 give the errors in prediction for different datasets using static linear prediction models. Tables 4.40-4.44 give the corresponding errors for sequential linear prediction models. We see an improvement in prediction for all the dataset, but still the errors in prediction for dataset D4 are quite high while D2 and D3 settle to almost comparable errors at quite lower values. Thus we can say either the sequential model is not able to incorporate very sudden changes in converter conditions or there are some errors in the data of dataset D4. The sequential model can not account for very steep changes in converter conditions, as total data points in the data file are 259 heats thus, coefficients of prediction equation represent the average converter condition over these 259 heats.

#### ***4.4.2 Trends in coefficients in sequential linear prediction models***

Coefficients of various terms in different prediction equations for group 1 (ORE2=0, RDOLO2=0) are plotted in Figs 4.38-4.67. We find pattern in some of the plots. In some of the plots we observe linear or exponential aging of the coefficients (Figs 4.40, 4.42, 4.43, 4.45, 4.46, 4.47, 4.48, 4.49, 4.51, 4.53, 4.54, 4.55, 4.57, 4.60, 4.61, 4.63, 4.65,

4.67). But in some of the plots we see that coefficients vary drastically from run to run (Figs 4.38, 4.39, 4.41, 4.44, 4.62). By examining the datasets we see that range and average values of lance height vary appreciably from run to run. This can cause the unexpected changes in the coefficients of lance height. Due to interaction of other variables with lance height their coefficients can also show some unexpected patterns. In some plots (for example Figs 4.47, 4.48, 4.54, 4.57) we see a sudden break at last run (RUN#5 mean index=370) from previous trends. This suggests that there may be some errors in the dataset D4. Predictions for dataset were also not as good as predictions for D1,D2 and D3, further strengthening the chances of error in dataset D4.

## ***4.5 Sequential linear prediction models for direct blow***

Sublance measurements before a few minutes of the end of blow, lowers productivity by some amount, as oxygen flow has to be reduced during the sublance measurement. Also the cost of sublance is high. This gives motivation for direct blow heats in which we can achieve the target end point composition and temperature without any sublance measurement. We developed sequential linear prediction models for direct blow. Tables 4.45-4.46 give the coefficients of different variables obtained in these runs. We developed these equations for carbon and temperature only. We used those heats only for which actual end point carbon was less than 0.060%. A total of 593 heats were used in these models. Regression data file of 173 heats was used and it was updated after every 60 heats.

### ***4.5.1 Predictions from direct blow models***

Plot of actual versus predicted end point carbon is shown in Fig 6.68. RMS error of prediction for end point carbon is 0.006248%. Plot of actual versus predicted end point temperature is shown in Fig 6.69. RMS error of end point temperature prediction is 12.611 degrees Kelvin. Thus, we see that these error values are higher than the error in prediction models using sublance information, but these error values can be acceptable for certain grades of steel where composition and temperature control are not that crucial.

Table 4.24

Heats included in each run of sequential  
Linear prediction models

RUN#	Heat# included	Index# of heats
1	1739-2555	1-259
2	1886-2854	61-319
3	2015-3100	121-379
4	2144-3397	181-439
5	2458-3688	241-499

Table 4.25 Coefficients of various terms in linear prediction equation for C2 for different runs (Group 1)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	3.7547e-02	4.3884e-02	3.9272e-02	3.2606e-02	3.9905e-02
O22	-1.284e-05	-1.335e-05	-1.289e-05	-1.242e-05	-1.418e-05
SVOL	3.3000e-07	4.0100e-07	3.2000e-07	3.3800e-07	5.4800e-07
CONSTANT	5.2936e-02	5.0269e-02	5.2450e-02	5.2164e-02	5.0222e-02

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.26 Coefficients of various terms<sup>+</sup> in linear prediction equation for T2 for different runs (Group 1)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	9.4154e-01	9.3108e-01	8.8440e-01	8.6104e-01	8.3777e-01
O22	4.2094e-02	4.1058e-02	4.1138e-02	3.9923e-02	3.8288e-02
HL2	6.6050e-02	1.0809e-01	7.6306e-02	1.1497e-01	8.6283e-02
HTR	9.8168e-01	1.9046e-01	2.3149e-01	1.5181e+00	3.0257e+00
CONSTANT	6.1880e+01	7.6057e+01	1.5600e+02	1.8235e+02	2.1992e+02

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

+Coefficient of LIM2 = -0.011978433

Table 4.27 Coefficients of various terms in linear prediction equation for Mn2 for different runs (Group 1)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	2.9978e-01	2.1550e-01	1.4708e-01	8.7420e-02	1.3634e-01
T1	7.4701e-04	8.8240e-04	9.1087e-04	9.1927e-04	8.7872e-04
C1	1.7199e-01	1.9277e-01	1.8459e-01	1.9037e-01	2.0388e-01
O22	-3.747e-05	-3.248e-05	-2.761e-05	-2.865e-05	-3.466e-05
HL2	1.2797e-04	7.2790e-05	-1.173e-05	-1.139e-04	-1.698e-04
C2	1.2535e+00	1.2091e+00	1.7922e+00	1.7098e+00	1.4425e+00
SVOL	-2.523e-06	-2.690e-06	-2.920e-06	-2.913e-06	-3.700e-06
HTR	-3.680e-03	-5.065e-03	-6.632e-03	-7.113e-03	-6.009e-03
BAS	3.9826e-03	2.4921e-03	2.0752e-03	3.2387e-04	3.9166e-04
CONSTANT	-1.167e+00	-1.332e+00	-1.352e+00	-1.309e+00	-1.224e+00

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.28 Coefficients of various terms<sup>+</sup> in linear prediction equation for P2 for different runs (Group 1)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.3330e-01	1.4727e-01	9.9392e-02	1.3506e-01	2.3855e-02
HL2	-1.973e-05	-1.889e-05	1.6120e-06	2.2424e-05	2.2545e-05
T2	5.0833e-05	3.5107e-05	3.1538e-05	3.7055e-05	1.0108e-05
C2	-4.483e-02	-1.056e-01	-1.205e-01	-1.325e-01	-1.274e-01
Mn2	6.3288e-02	7.7672e-02	9.0919e-02	9.2687e-02	1.0423e-01
SVOL	-2.410e-07	-1.290e-07	-1.800e-07	-2.620e-07	-1.590e-07
HTR	1.6742e-04	4.7225e-04	5.0958e-04	6.8651e-04	1.0596e-03
CONSTANT	-8.730e-02	-6.010e-02	-5.604e-02	-7.003e-02	-2.430e-02

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

+Coefficient of DOLO2 = 0.000001519

Table 4.29 Coefficients of various terms<sup>+</sup> in linear prediction equation for Oact2 for different runs (Group 1)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
HL2	-2.787e+00	1.4274e+00	4.0442e+00	5.6453e+00	5.4662e+00
C2	-2.185e+04	-1.935e+04	-1.922e+04	-2.304e+04	-2.422e+04
CONSTANT	2.4004e+03	1.3533e+03	7.8701e+02	6.5441e+02	7.5457e+02

\*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

+Coefficient of LIM2 = 0.363741457, Coefficient of DOLO2 = 0.109627701

Table 4.30 Coefficients of various terms in linear prediction equation for C2 for different runs (Group 2)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	3.0486e-02	4.0233e-02	3.4390e-02	4.2803e-02	3.6468e-02
O22	-1.572e-05	-1.734e-05	-1.563e-05	-1.566e-05	-1.285e-05
HL2	2.7931e-05	3.3173e-05	3.7363e-05	3.2992e-05	6.5764e-05
SVOL	5.0000e-07	5.5200e-07	1.7300e-07	1.5100e-07	-2.300e-08
CONSTANT	5.2857e-02	5.0264e-02	5.5398e-02	5.3008e-02	4.8248e-02

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.31 Coefficients of various terms<sup>+</sup> in linear prediction equation for T2 for different runs (Group 2)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	8.9813e-01	8.6499e-01	8.1230e-01	8.1937e-01	7.9788e-01
O22	3.3752e-02	3.2170e-02	3.2017e-02	3.1749e-02	3.2946e-02
RDOLO2	-8.931e-03	-8.946e-03	-8.234e-03	-7.958e-03	-1.111e-02
HL2	-3.372e-02	3.5311e-02	6.5534e-02	9.8450e-02	4.9649e-02
CONSTANT	1.7226e+02	2.1324e+02	2.9070e+02	2.7406e+02	3.1605e+02

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

+Coefficient of LIM2 = -0.022366848, Coefficient of DOLO2 = -0.005296942,  
Coefficient of RSL2 = -0.009144903

Table 4.32 Coefficients of various terms<sup>+</sup> in linear prediction equation for Mn2 for different runs (Group 2)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	3.1602e-01	2.3045e-01	2.5028e-01	3.1495e-01	2.3651e-01
T1	1.2301e-03	8.5427e-04	9.2976e-04	8.8884e-04	6.7657e-04
C1	2.0252e-01	1.6336e-01	1.6239e-01	1.2708e-01	1.6722e-01
O22	-3.503e-05	-3.721e-05	-2.931e-05	-2.512e-05	-4.275e-05
RDOLO2	-1.876e-05	-1.595e-05	-1.424e-05	-1.520e-05	-1.868e-05
T2	-2.234e-04	1.7363e-04	1.5941e-04	5.9517e-05	-9.859e-05
C2	1.1846e+00	1.3628e+00	1.6019e+00	1.4779e+00	4.3475e-01
SVOL	-3.771e-06	-4.069e-06	-4.022e-06	-4.371e-06	-8.210e-07
BAS	-2.496e-03	-2.756e-03	-1.293e-03	-1.976e-03	2.7317e-03
CONSTANT	-1.516e+00	-1.523e+00	-1.664e+00	-1.436e+00	-8.312e-01

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

+Coefficient of DOLO2 = -0.000005231



Table 4.33 Coefficients of various terms in linear prediction equation for P2 for different runs (Group 2)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.2453e-01	2.0559e-01	5.9080e-02	1.1727e-01	-2.344e-01
HL2	-3.057e-05	-2.240e-05	-8.175e-06	1.3528e-05	1.1758e-05
T2	8.8712e-05	7.3694e-05	6.1296e-05	5.3743e-05	2.0978e-05
C2	4.4940e-02	3.4248e-02	-5.893e-03	-1.367e-02	-8.718e-02
Mn2	4.4378e-02	5.5017e-02	6.7712e-02	7.5864e-02	1.0021e-01
SVOL	-3.760e-07	-2.980e-07	-3.400e-07	-3.360e-07	-9.200e-08
CONSTANT	-1.445e-01	-1.233e-01	-9.652e-02	-9.182e-02	-2.199e-02

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.34 Coefficients of various terms in linear prediction equation for Oact2 for different runs (Group 2)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	-8.986e+00	-1.016e+01	-8.474e+00	-6.178e+00	-5.409e+00
C1	-9.646e+02	-1.031e+03	-7.874e+02	-4.705e+02	-5.895e+02
RDOLO2	8.3450e-02	1.2050e-01	1.0726e-01	9.0109e-02	8.3956e-02
T2	1.0365e+01	1.2136e+01	9.2947e+00	7.9808e+00	5.7674e+00
C2	-9.678e+03	-4.052e+03	-3.599e+03	-6.036e+03	-7.192e+03
HTR	-3.063e+01	-3.464e+01	-2.081e+01	-2.401e+01	-1.071e+01
CONSTANT	-1.218e+03	-2.569e+03	-7.653e+02	-2.204e+03	2.6989e+02

\*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

+Coefficient of LIM2 = 0.346866310, Coefficient of RSL2 = 0.161082357

Table 4.35 Coefficients of various terms<sup>+</sup> in linear prediction equation for C2 for different runs (Group 3)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	4.6433e-02	4.5302e-02	4.6350e-02	4.9363e-02	4.2695e-02
O22	-1.962e-05	-1.559e-05	-1.557e-05	-1.253e-05	-1.163e-05
ORE2	5.8350e-06	3.3370e-06	2.8580e-06	5.2360e-06	1.2500e-07
HL2	1.5929e-04	6.4107e-05	4.4504e-05	2.8412e-05	6.3175e-05
CONSTANT	3.2933e-02	4.7801e-02	5.1027e-02	4.5188e-02	4.3186e-02

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

+Coefficient of LIM2 = -0.000018092

Table 4.36 Coefficients of various terms<sup>+</sup> in linear prediction equation for T2 for different runs (Group 3)<sup>\*</sup>

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	9.4805e-01	8.5877e-01	8.8292e-01	8.9918e-01	8.5656e-01
O22	4.4258e-02	3.9606e-02	3.7683e-02	3.6983e-02	3.5667e-02
ORE2	-2.229e-02	-2.091e-02	-1.677e-02	-1.708e-02	-1.288e-02
HL2	-7.676e-02	6.1619e-02	1.0731e-01	1.1449e-01	3.5690e-02
HTR	1.9170e+00	1.1168e+00	4.3178e-01	7.3430e-01	4.9358e-01
CONSTANT	7.9490e+01	2.0617e+02	1.6356e+02	1.3564e+02	2.1774e+02

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

+Coefficient of RSL2 = -0.006884490

Table 4.37 Coefficients of various terms<sup>+</sup> in linear prediction equation for Mn2 for different runs (Group 3)<sup>\*</sup>

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	2.4597e-01	2.2094e-01	2.1517e-01	3.2295e-01	7.2071e-02
T1	1.0135e-03	1.0879e-03	9.7712e-04	1.2038e-03	6.3331e-04
C1	1.9585e-01	2.2574e-01	2.2954e-01	2.0347e-01	2.4715e-01
O22	-2.831e-05	-3.032e-05	-3.766e-05	-2.322e-05	-5.743e-05
RDOLO2	-2.789e-05	-2.000e-05	-1.019e-05	-1.175e-05	-2.208e-05
T2	4.1075e-05	-2.801e-04	-1.045e-04	-2.647e-04	3.1814e-04
C2	1.7196e+00	1.0481e+00	1.2351e+00	1.3345e+00	-1.736e-01
SVOL	-3.023e-06	-3.090e-06	-3.298e-06	-3.489e-06	3.3500e-07
BAS	-5.209e-03	-1.035e-03	-1.156e-03	8.9613e-04	1.9298e-03
CONSTANT	-1.618e+00	-1.188e+00	-1.298e+00	-1.470e+00	-1.386e+00

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

+Coefficient of LIM2= -0.000042552, Coefficient of DOLO2 = -0.000010484,  
Coefficient of RSL2 = -0.000003391

Table 4.38 Coefficients of various terms in linear prediction equation for P2 for different runs (Group 3)<sup>\*</sup>

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.4087e-01	2.2437e-01	-1.394e-02	1.0375e-01	-3.535e-02
ORE2	-1.941e-06	-1.052e-06	-4.600e-08	1.0680e-06	-5.900e-07
HL2	-4.304e-05	-2.721e-05	-2.094e-05	8.3500e-07	-4.234e-06
T2	4.2922e-05	5.6860e-05	7.0249e-05	6.3179e-05	3.4645e-05
Mn2	4.4620e-02	5.4115e-02	6.7243e-02	6.6679e-02	7.4568e-02
SVOL	-3.020e-07	-2.260e-07	-1.500e-07	-2.940e-07	-1.160e-07
CONSTANT	-6.562e-02	-9.540e-02	-1.095e-01	-1.057e-01	-5.277e-02

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.39 Coefficients of various terms<sup>+</sup> in linear prediction equation for Oact2 for different runs (Group 3)\*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
ORE2	-1.420e-01	-9.347e-02	-5.738e-02	-1.005e-01	-4.707e-02
HL2	-2.218e+00	2.2330e+00	2.9733e+00	4.1144e+00	1.9671e+00
C2	-1.962e+04	-1.894e+04	-1.520e+04	-1.552e+04	-1.456e+04
CONSTANT	2.1992e+03	1.1533e+03	8.1836e+02	6.6852e+02	9.5638e+02

\*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

+Coefficient of LIM2 = -0.435371697

Table 4.40 Deviation of predicted carbon (wt%) from actual carbon using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.00440	0.00519	0.00751
RMS deviation	0.00547	0.00638	0.00957

Table 4.41 Deviation of predicted temperature ( $^{\circ}\text{K}$ ) from actual temperature using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	6.23	7.54	8.30
RMS deviation	7.86	9.95	10.93

Table 4.42 Deviation of predicted manganese (wt%) from actual manganese using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.01486	0.02004	0.04101
RMS deviation	0.01963	0.02816	0.04760

Table 4.43 Deviation of predicted phosphorus (wt%) from actual phosphorus using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.00203	0.00388	0.00496
RMS deviation	0.00269	0.00474	0.00559

Table 4.44 Deviation of predicted dissolved oxygen (ppm) from actual dissolved oxygen using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	211.43	229.54	236.51
RMS deviation	264.09	236.51	264.78

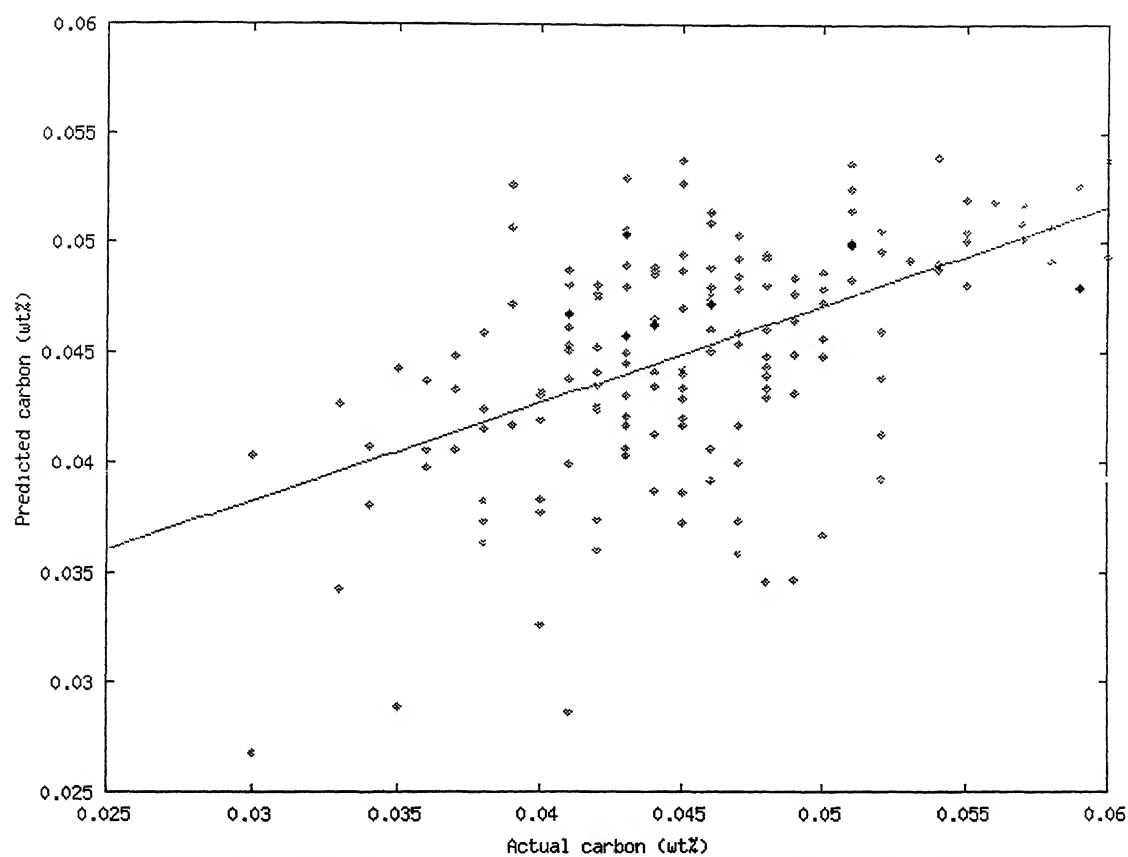


Fig 4.23 Predicted carbon versus actual carbon in wt% for dataset D2 using sequential linear prediction equations

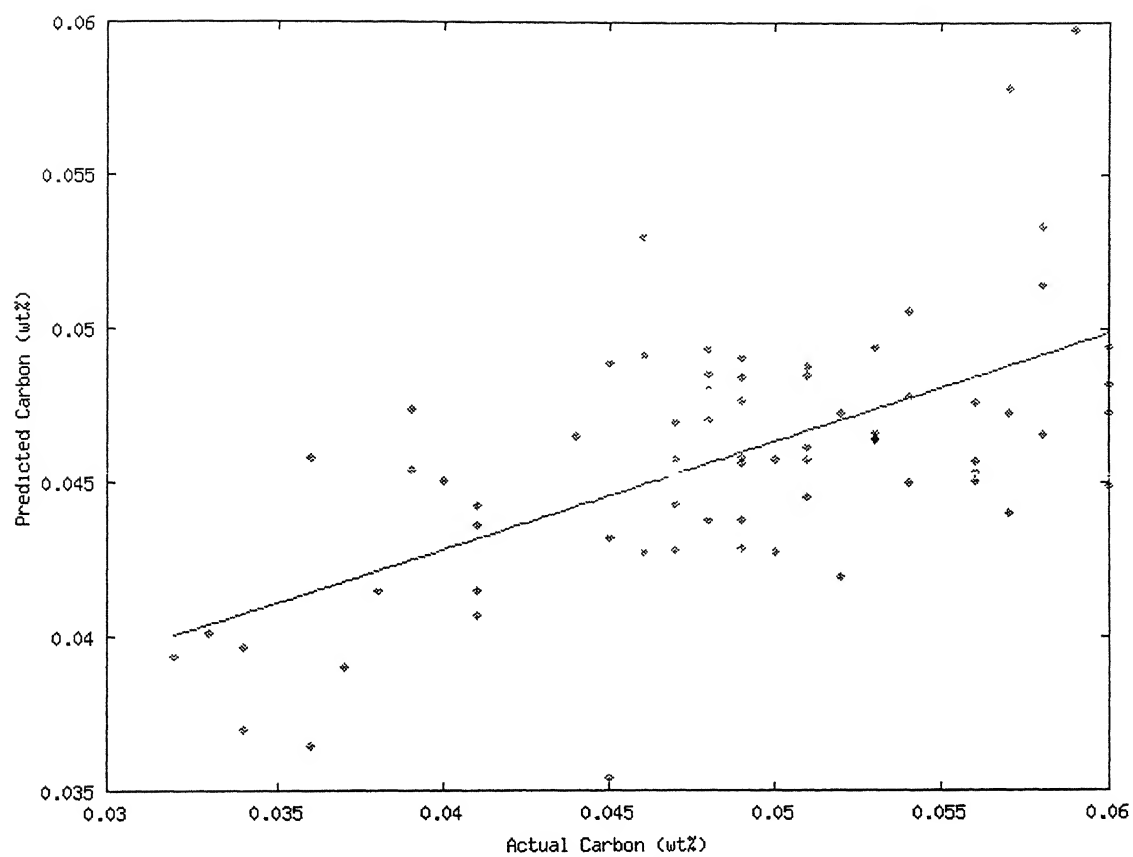


Fig 4.24 Predicted carbon versus actual carbon in wt% for dataset D3 using sequential linear prediction equations

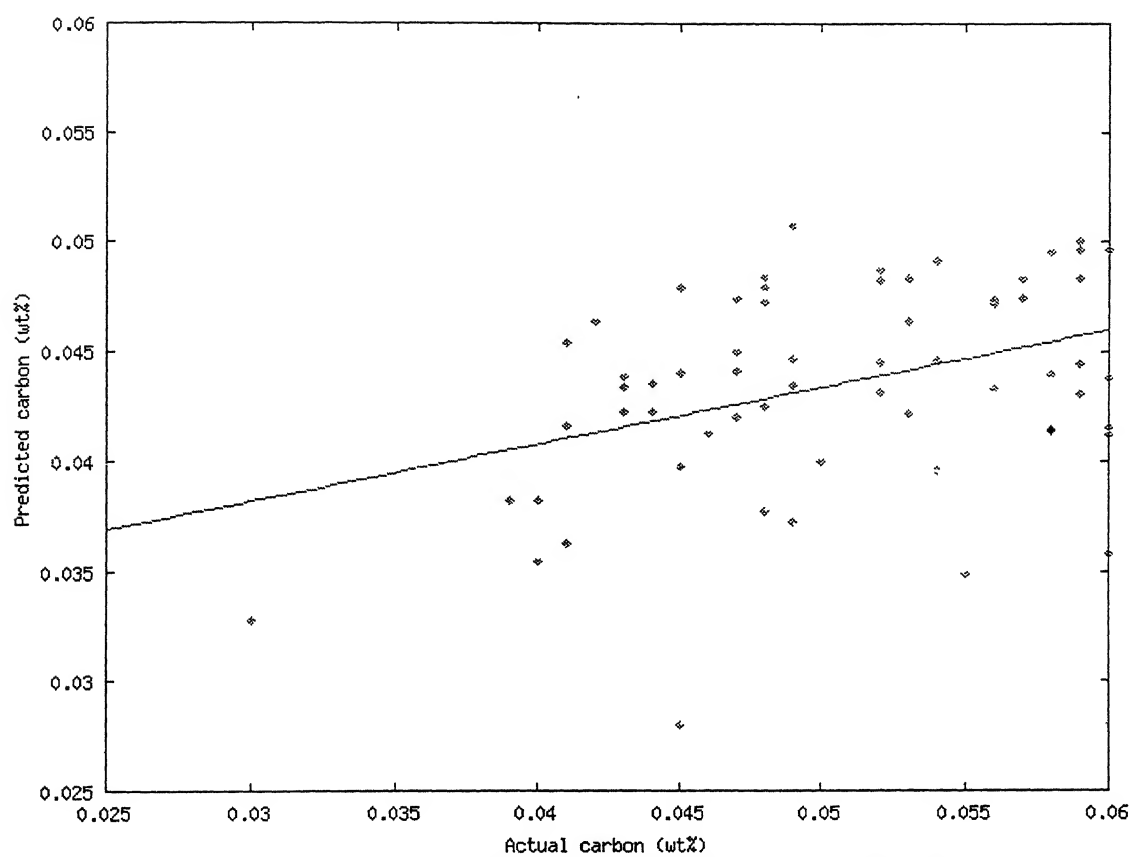


Fig 4.25 Predicted carbon versus actual carbon in wt% for dataset D4 using sequential linear prediction equations

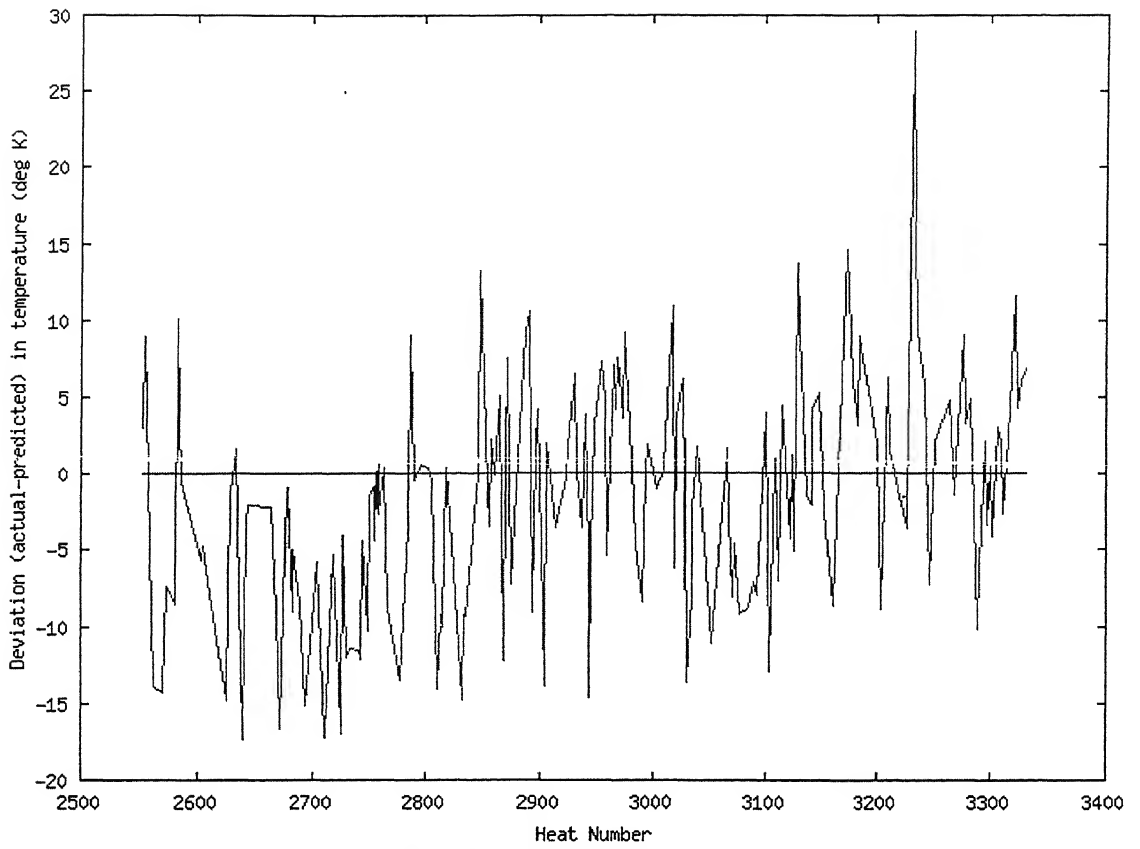


Fig 4.26 Deviation (actual-predicted) in temperature versus heat number for dataset D2 using sequential linear prediction equations



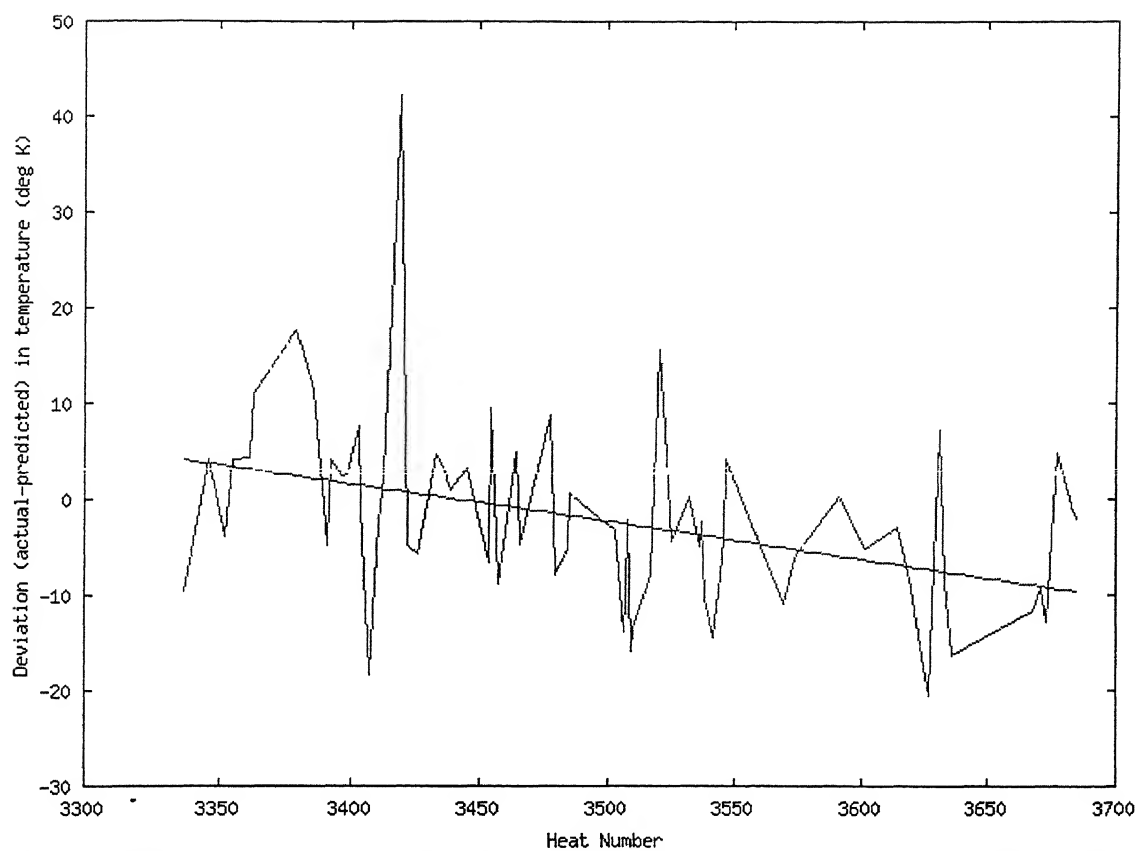


Fig 4.27 Deviation (actual-predicted) in temperature versus heat number for dataset D3 using sequential linear prediction equations

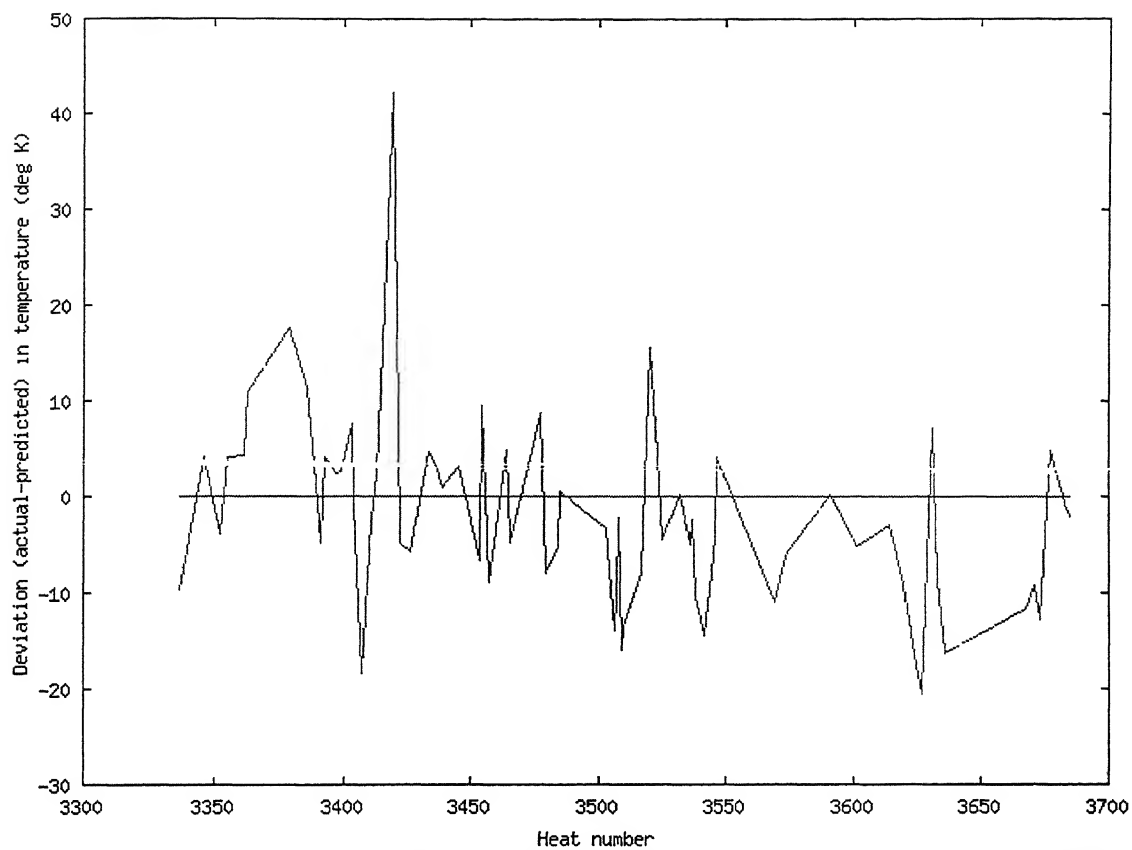


Fig 4.28 Deviation (actual-predicted) in temperature versus heat number for dataset D4 using sequential linear prediction equations

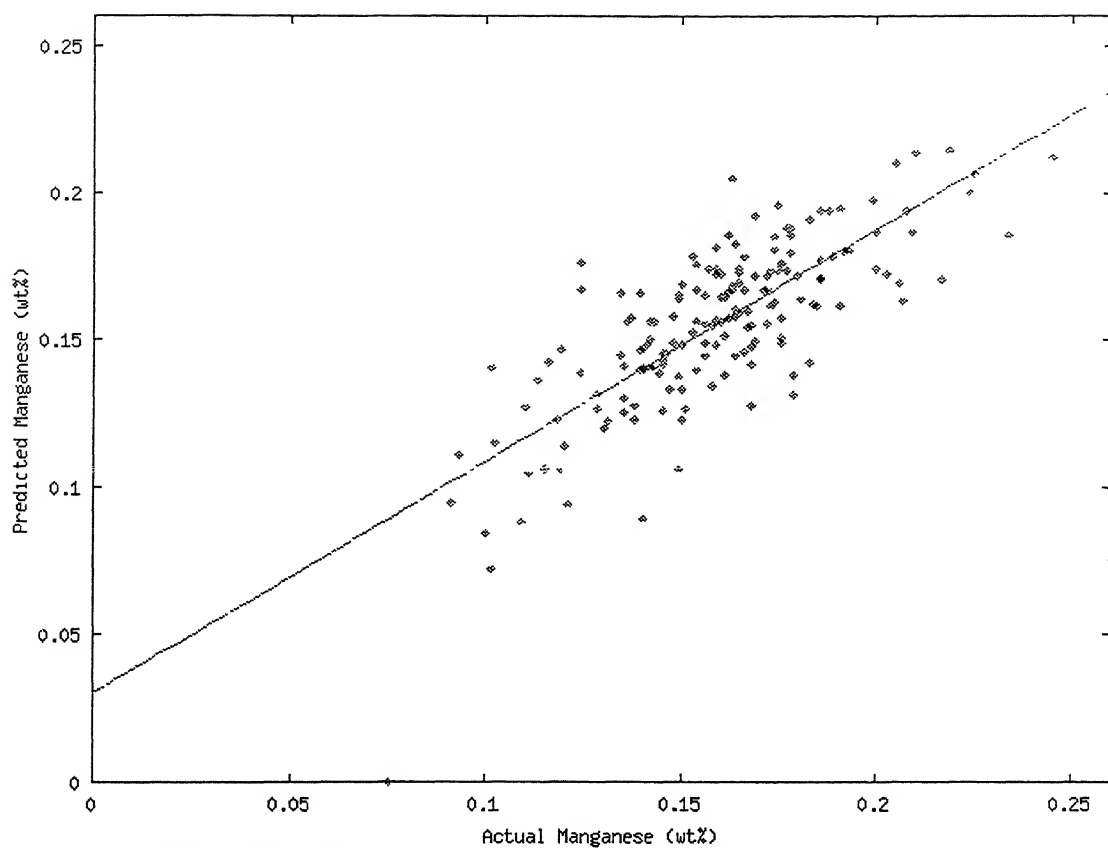


Fig 4.29 Predicted versus actual manganese for dataset D2 using sequential linear prediction equations

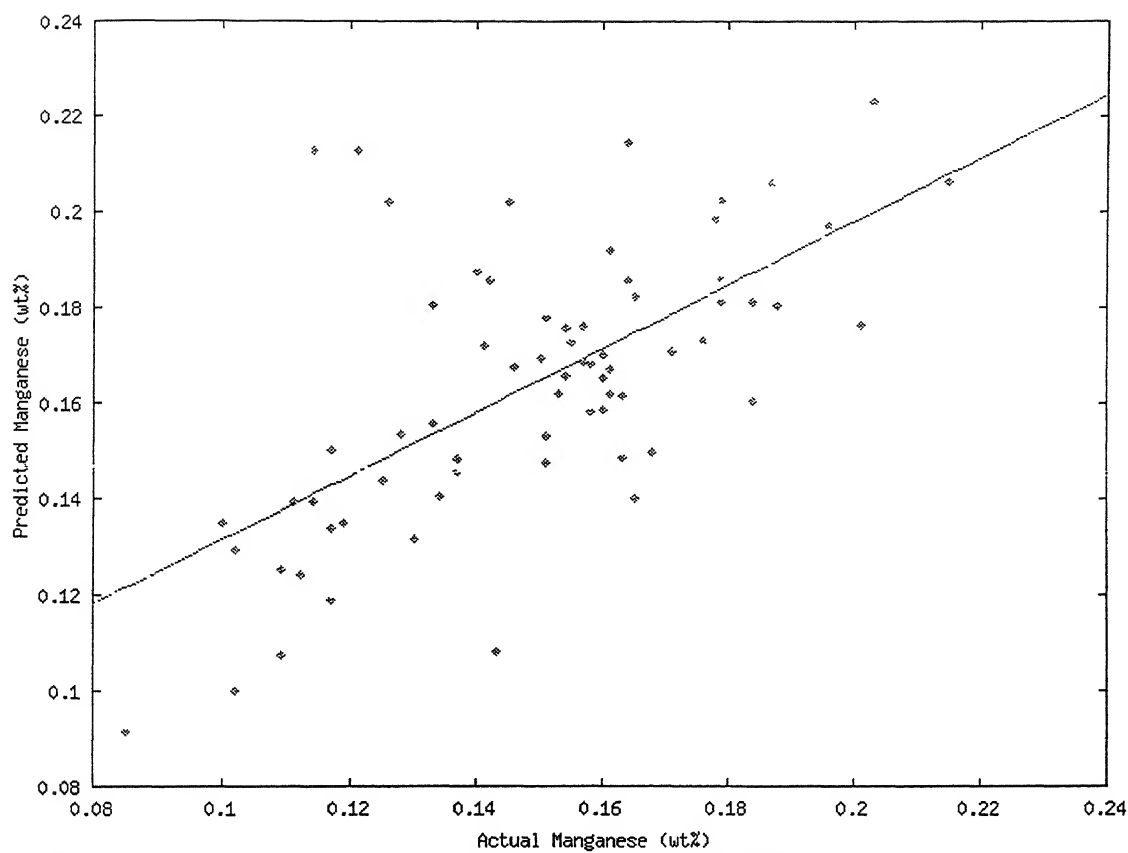


Fig 4.30 Predicted versus actual manganese for dataset D3 using sequential linear prediction equations

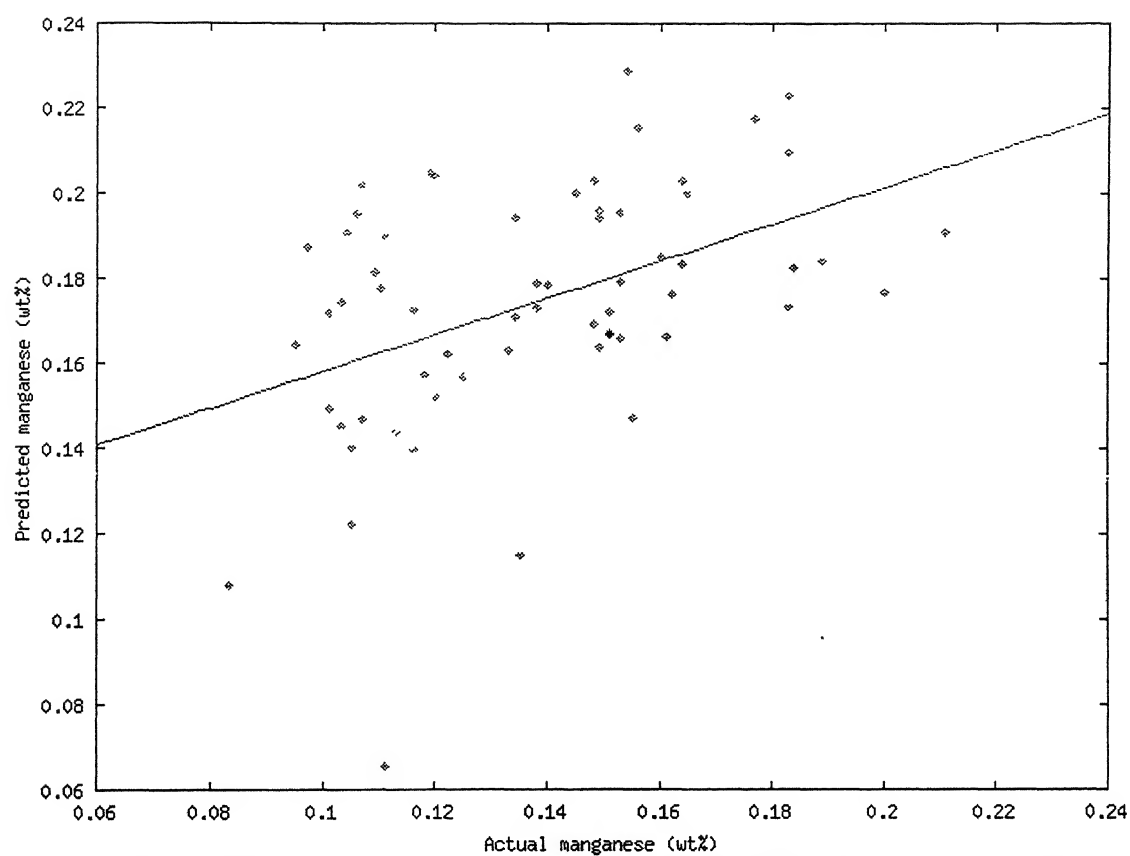


Fig 4.31 Predicted versus actual manganese for dataset D4 using sequential linear prediction equations

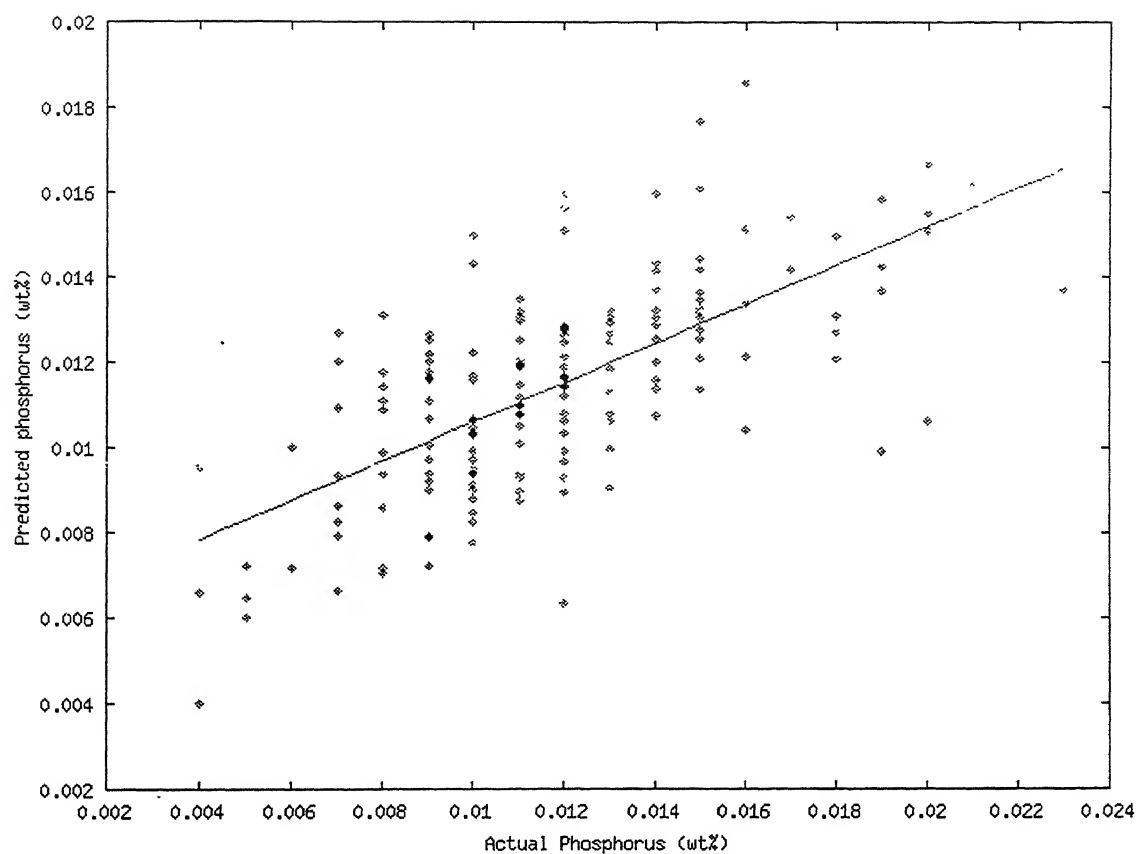


Fig 4.32 Predicted versus actual phosphorus for dataset D2 using sequential linear prediction equations

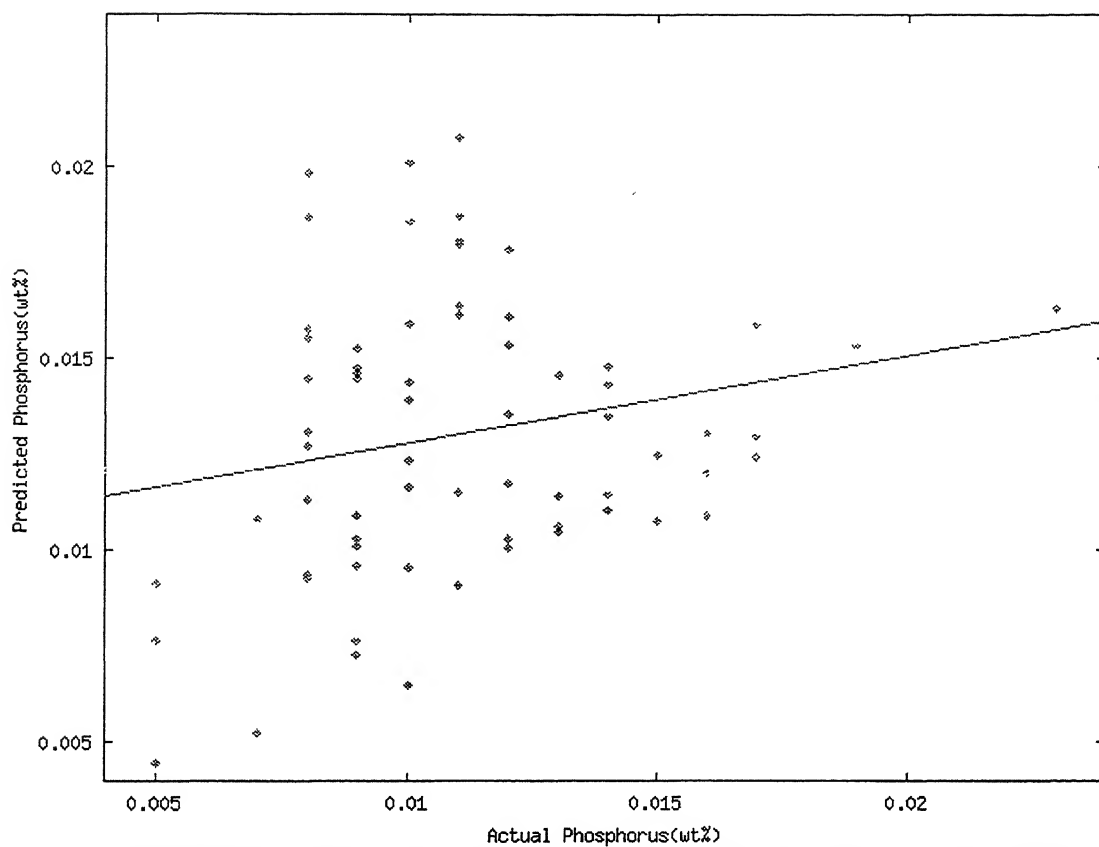


Fig 4.33 Predicted versus actual phosphorus for dataset D3 using sequential linear prediction equations

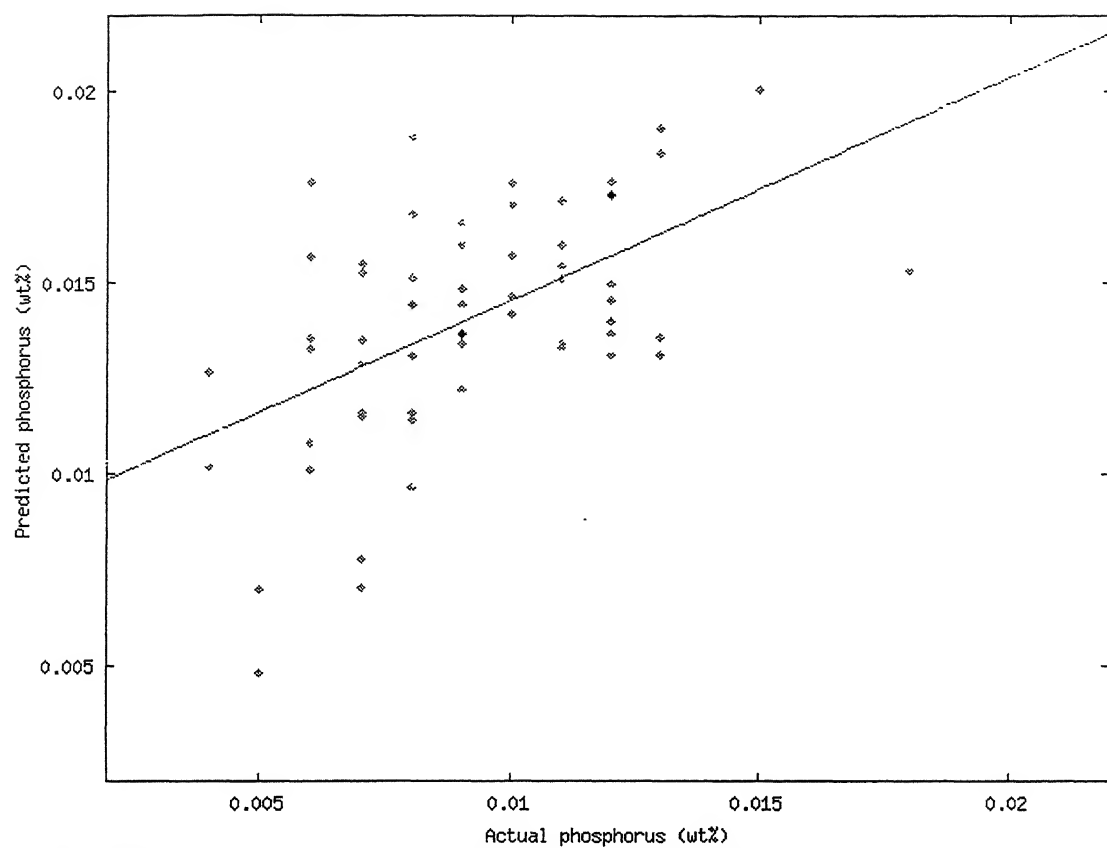


Fig 4.34 Predicted versus actual phosphorus for dataset D4 using sequential linear prediction equations



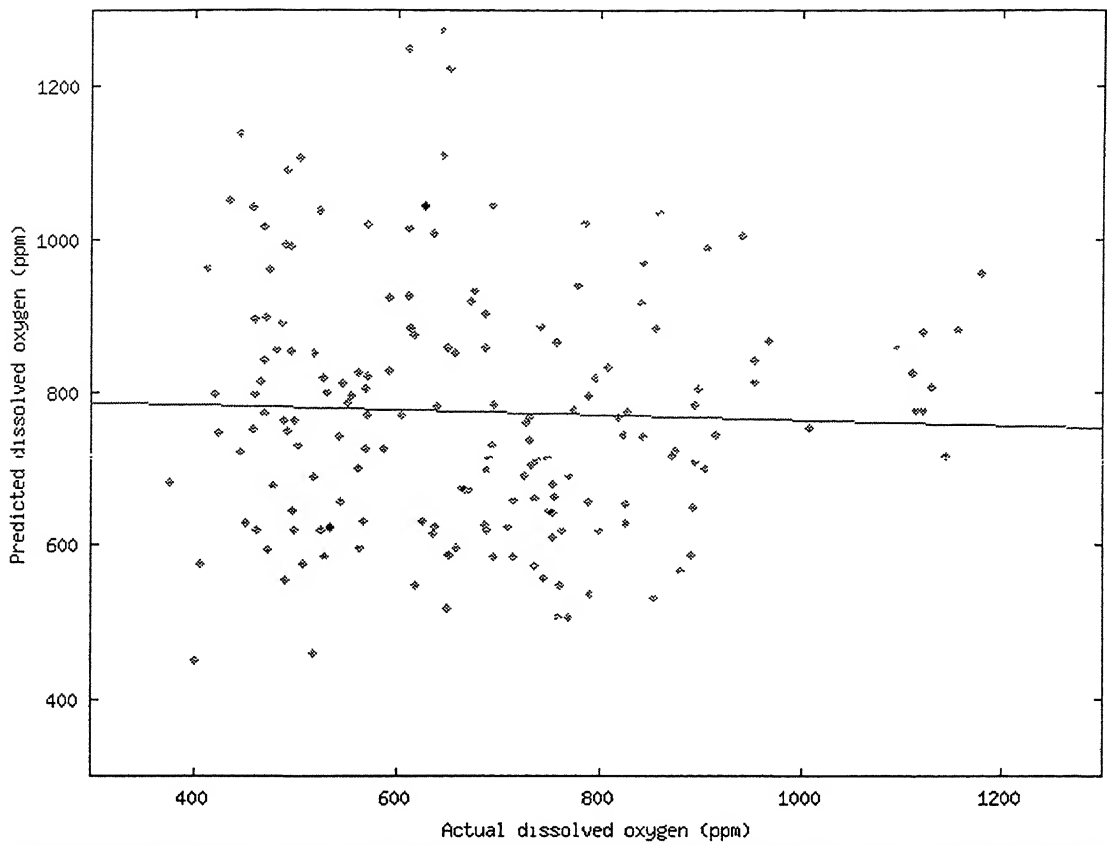


Fig 4.35 Predicted versus actual dissolved oxygen for dataset D2 using sequential linear prediction equations

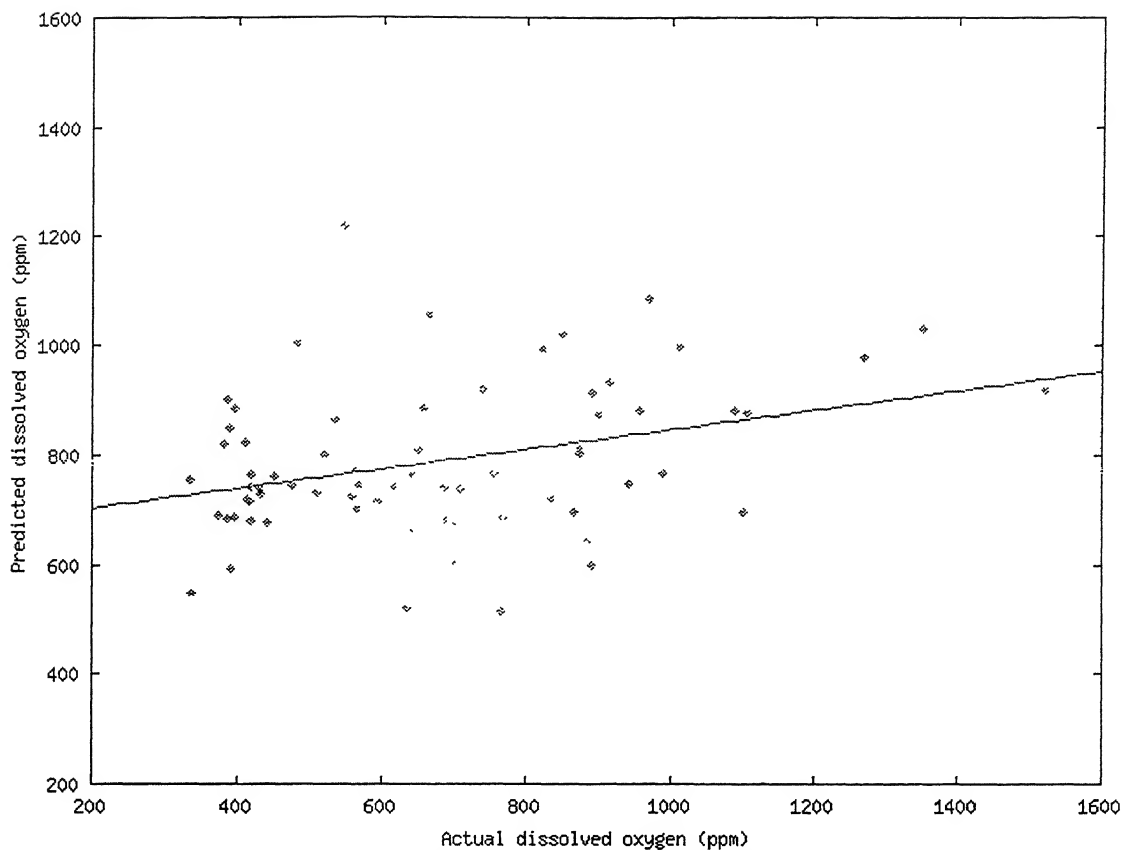


Fig 4.36 Predicted versus actual dissolved oxygen for dataset D3 using sequential linear prediction equations

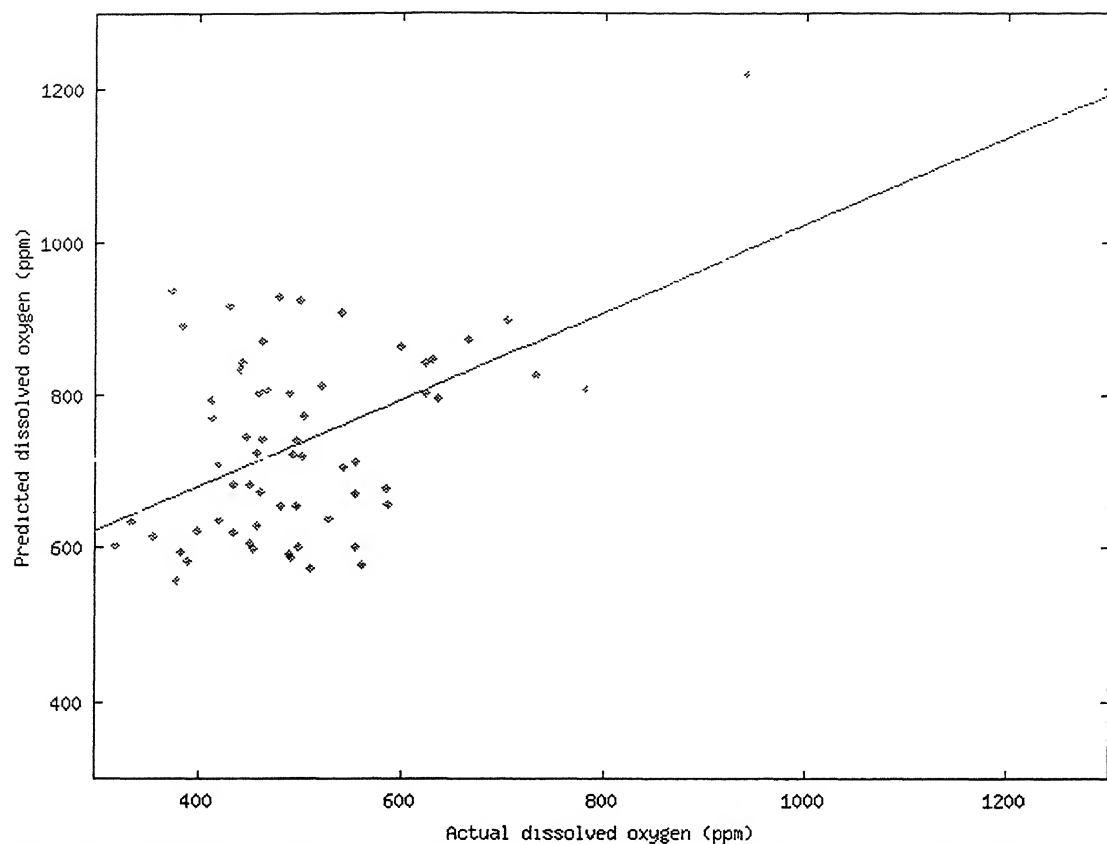


Fig 4.37 Predicted versus actual dissolved oxygen for dataset D4 using sequential linear prediction equations

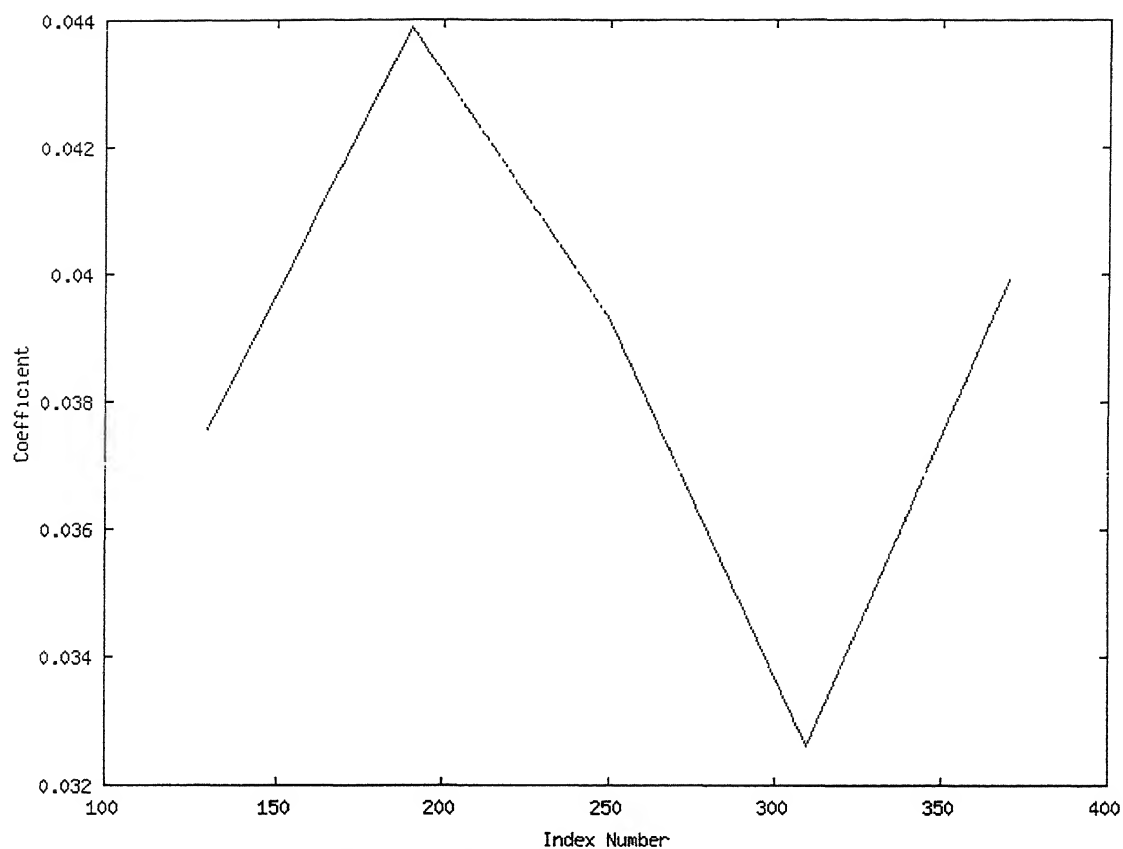


Fig 4.38 Variation of coefficient of C1 in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOL02 and ORE2 is added)

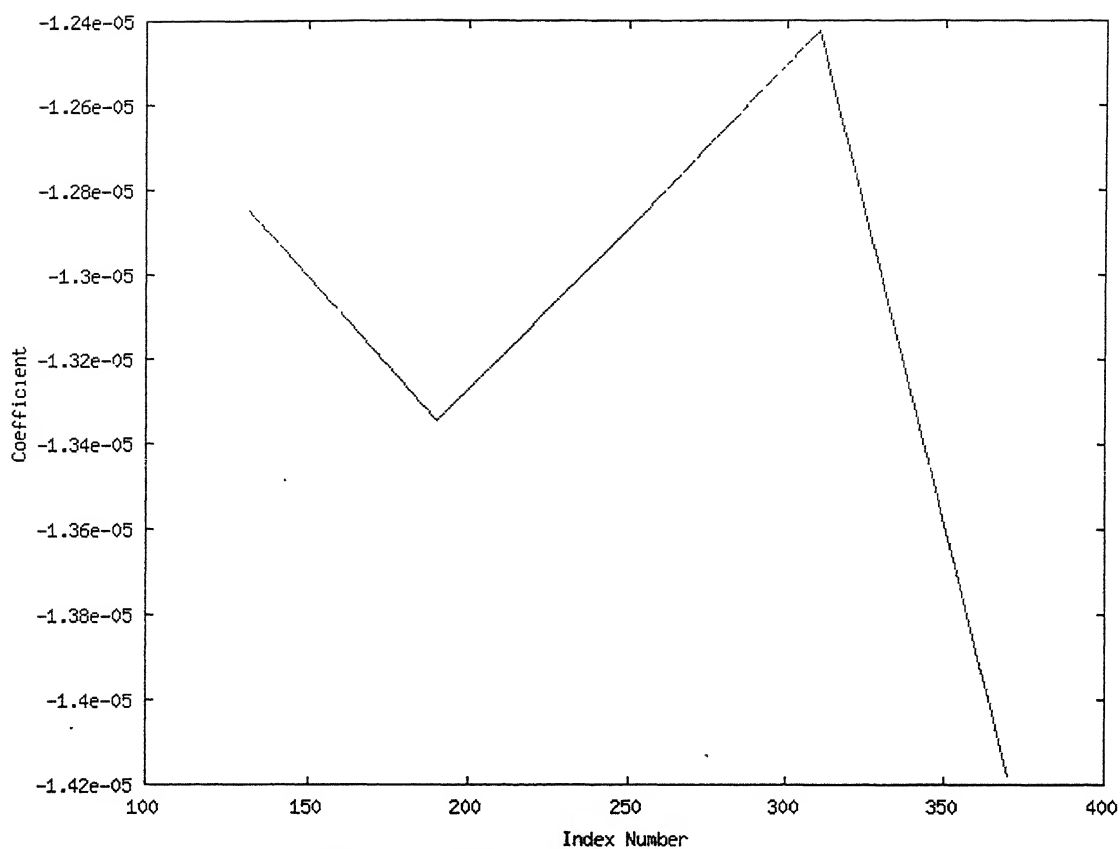


Fig 4.39 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

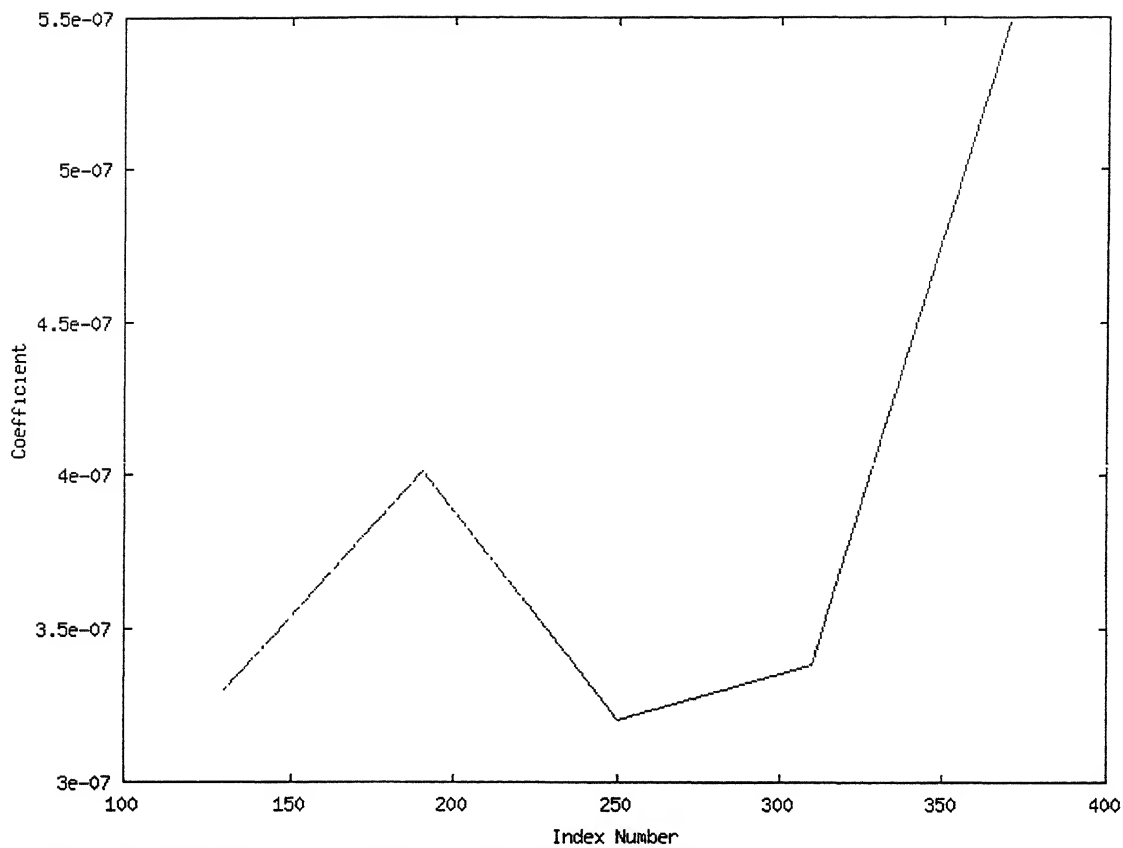


Fig 4.40 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

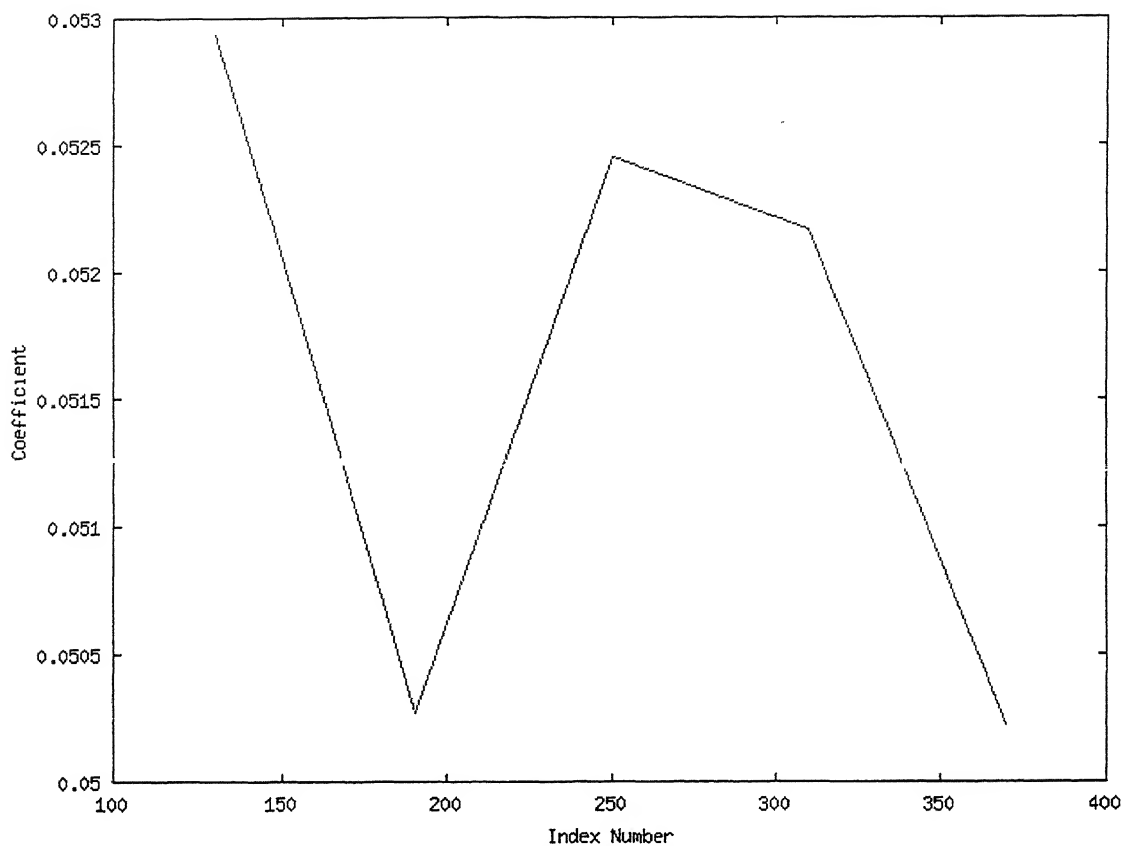


Fig 4.41 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

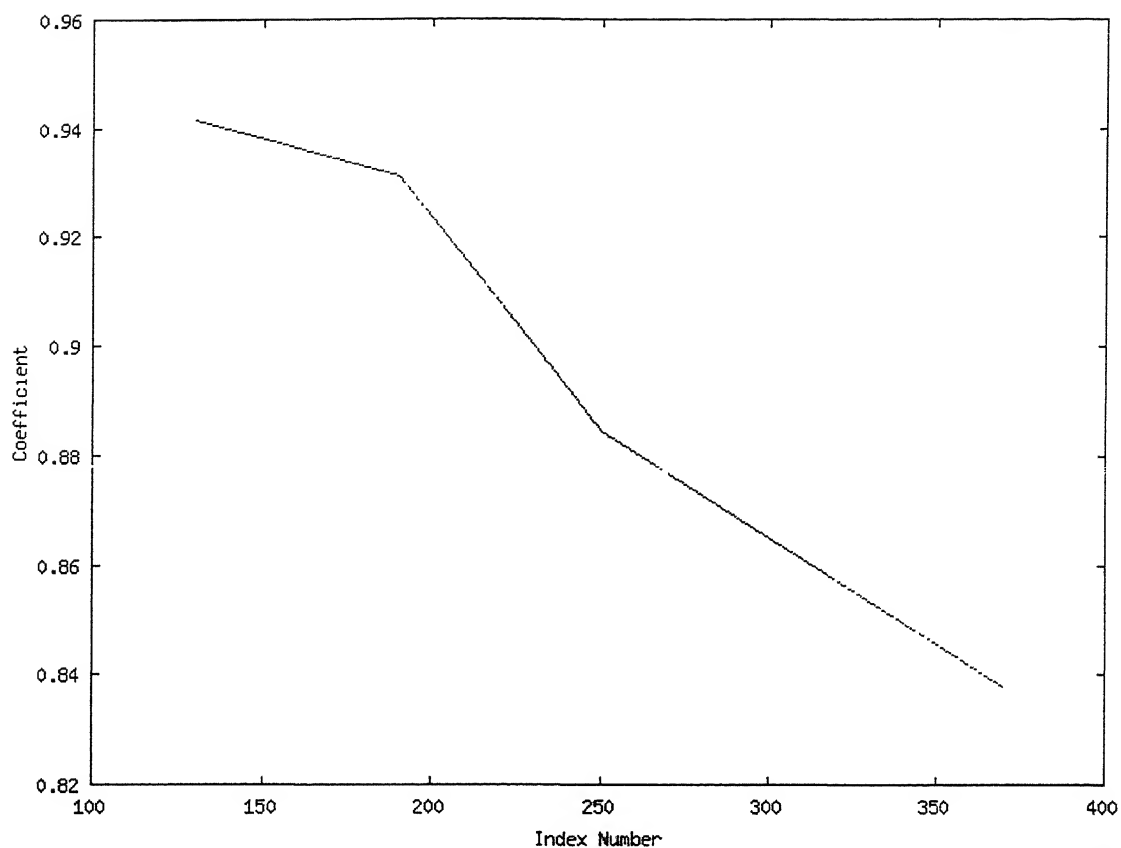


Fig 4.42 Variation of coefficient of T1 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)



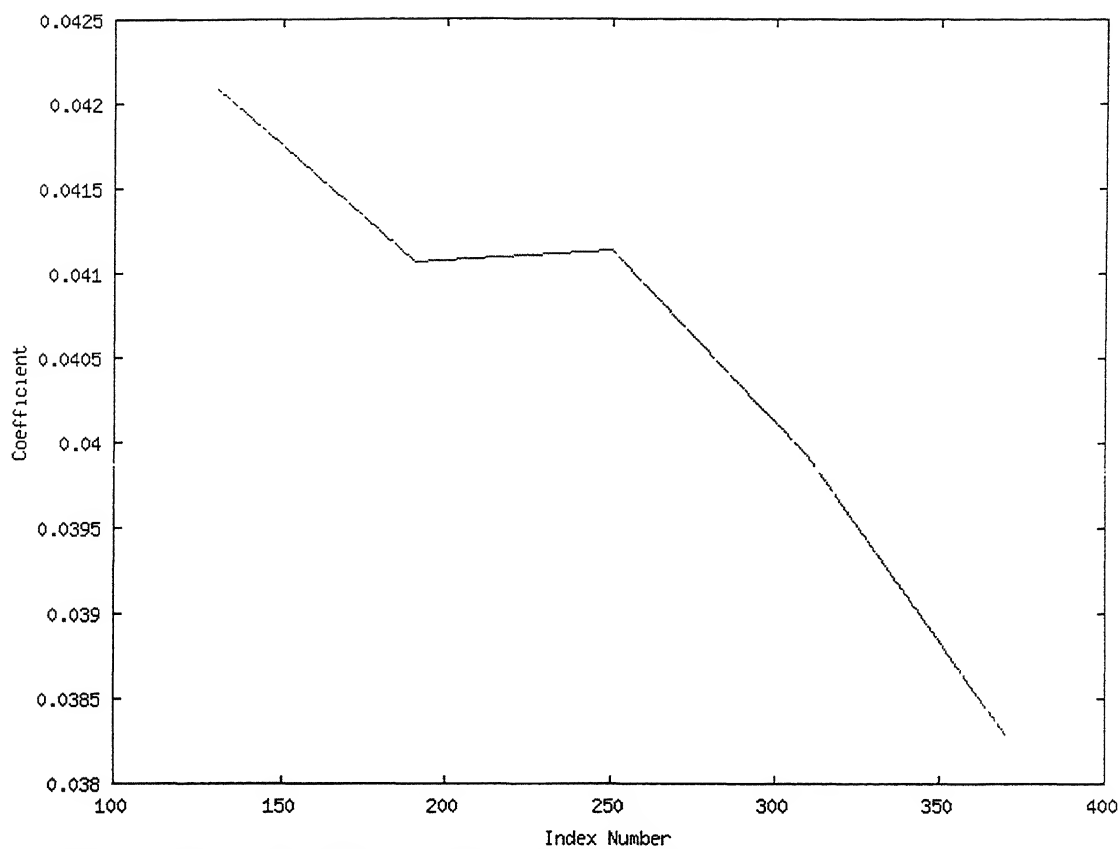


Fig 4.43 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

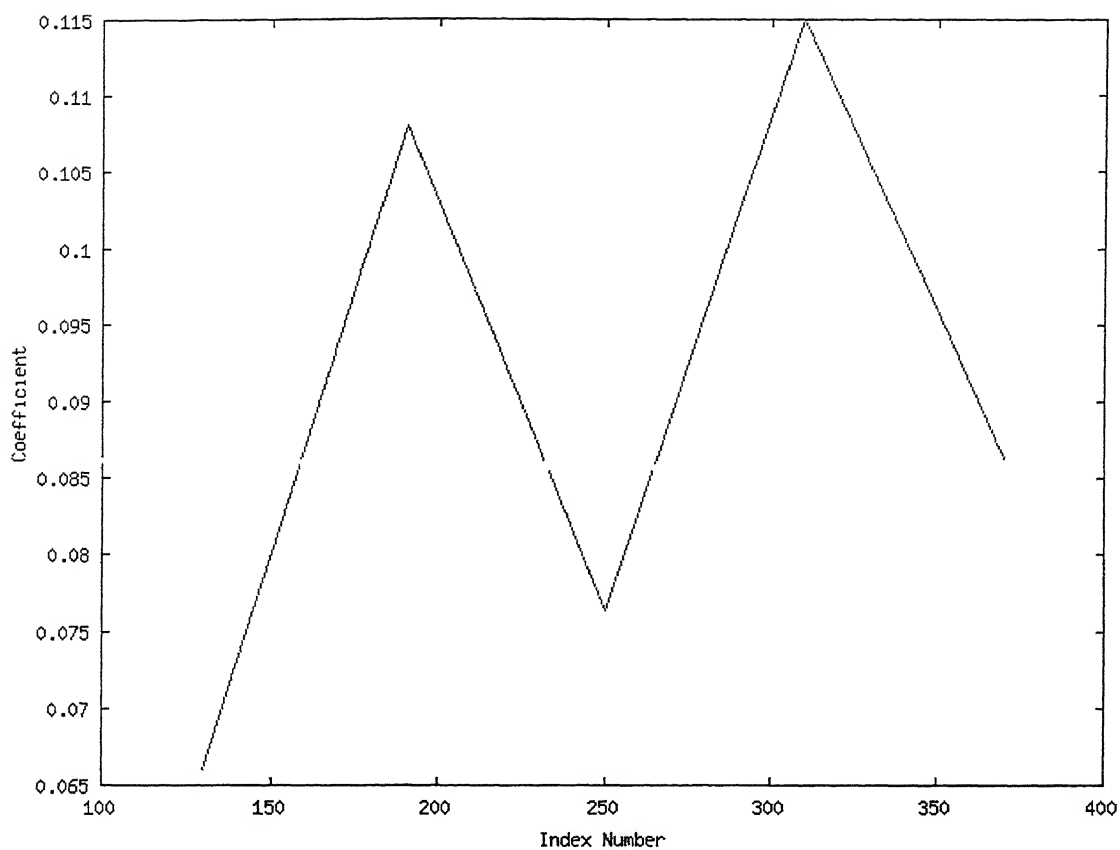


Fig 4.44 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

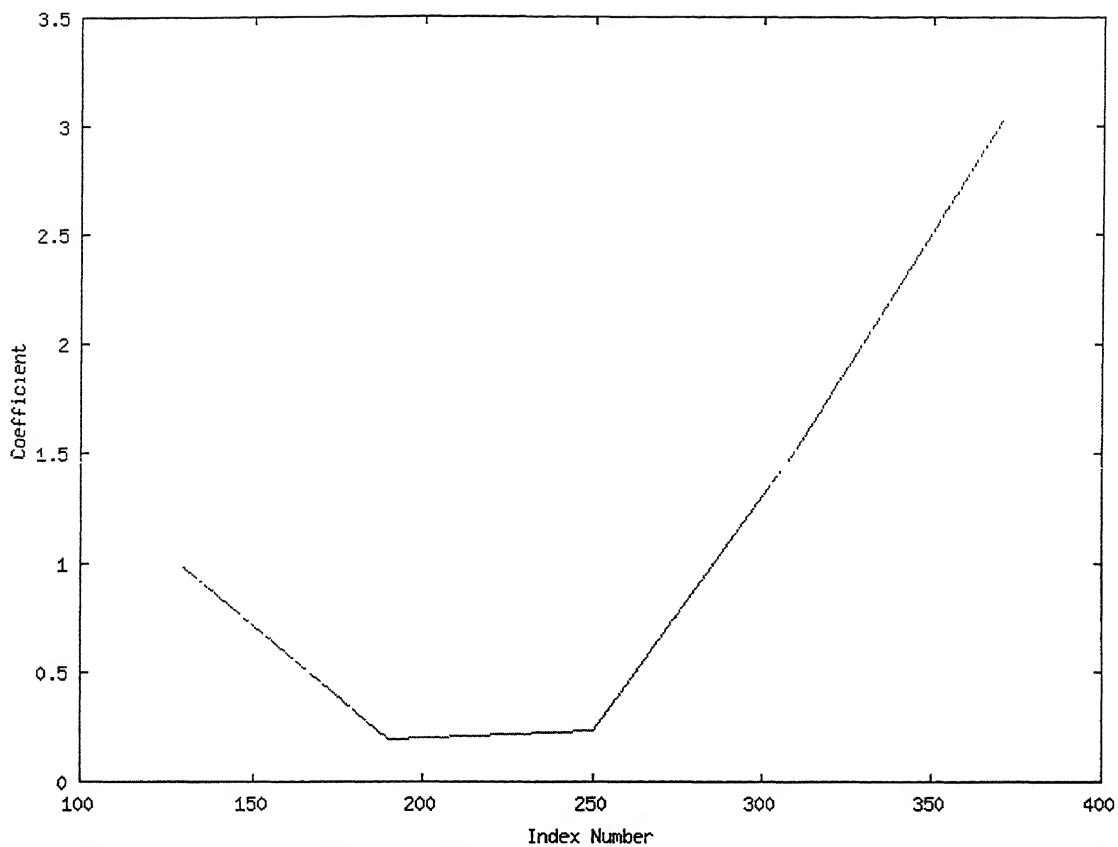


Fig 4.45 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDQLO2 and ORE2 is added)

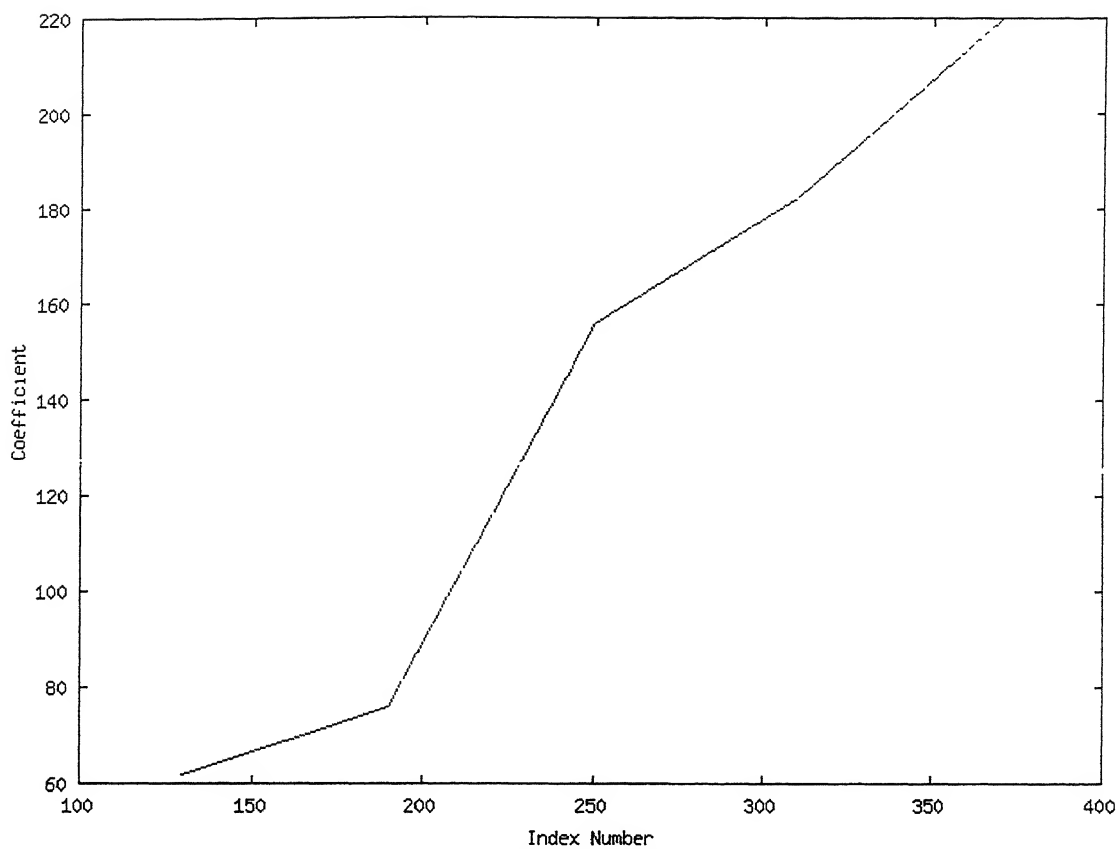


Fig 4.46 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

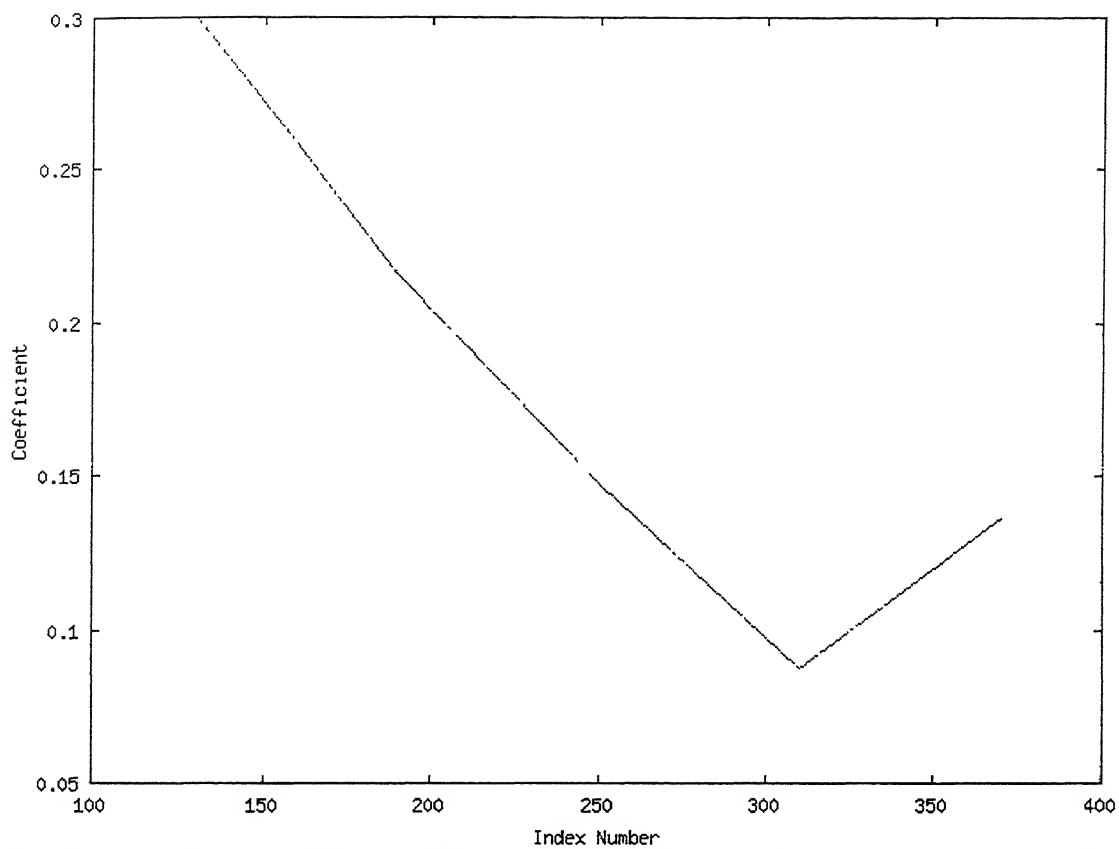


Fig 4.47 Variation of coefficient of Mn0 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

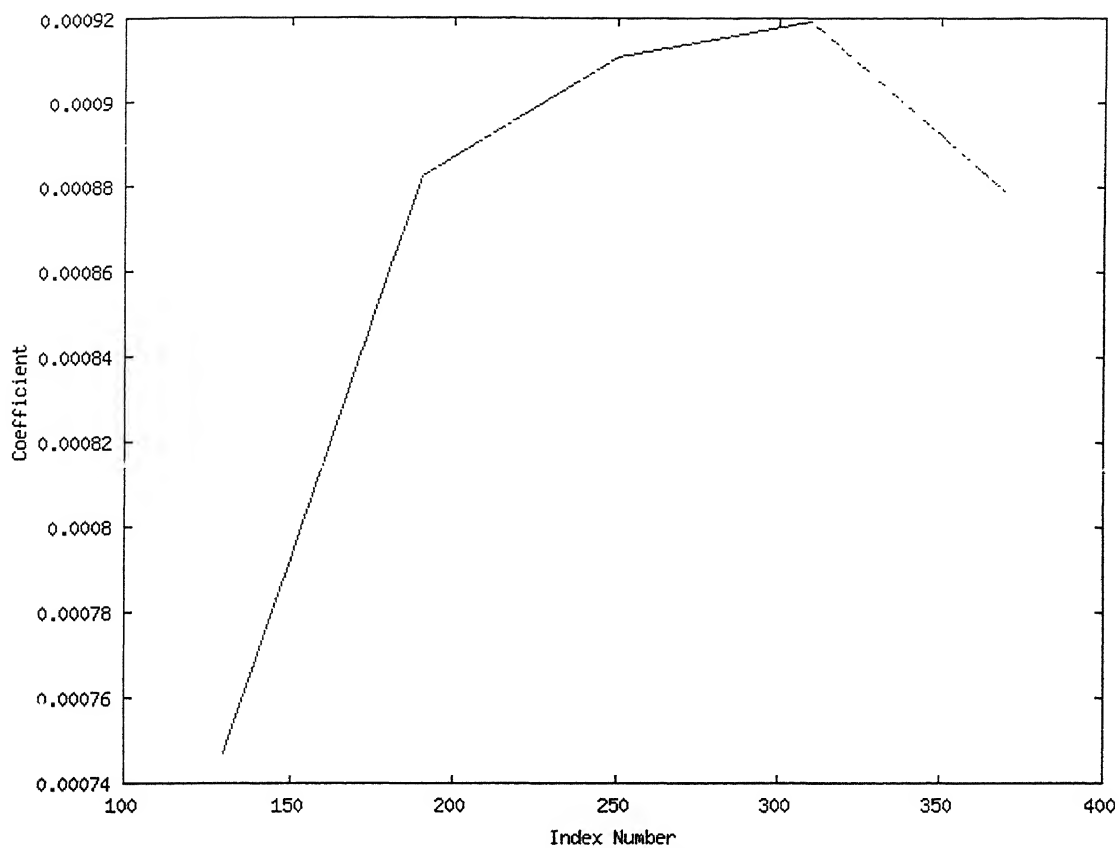


Fig 4.48 Variation of coefficient of T1 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

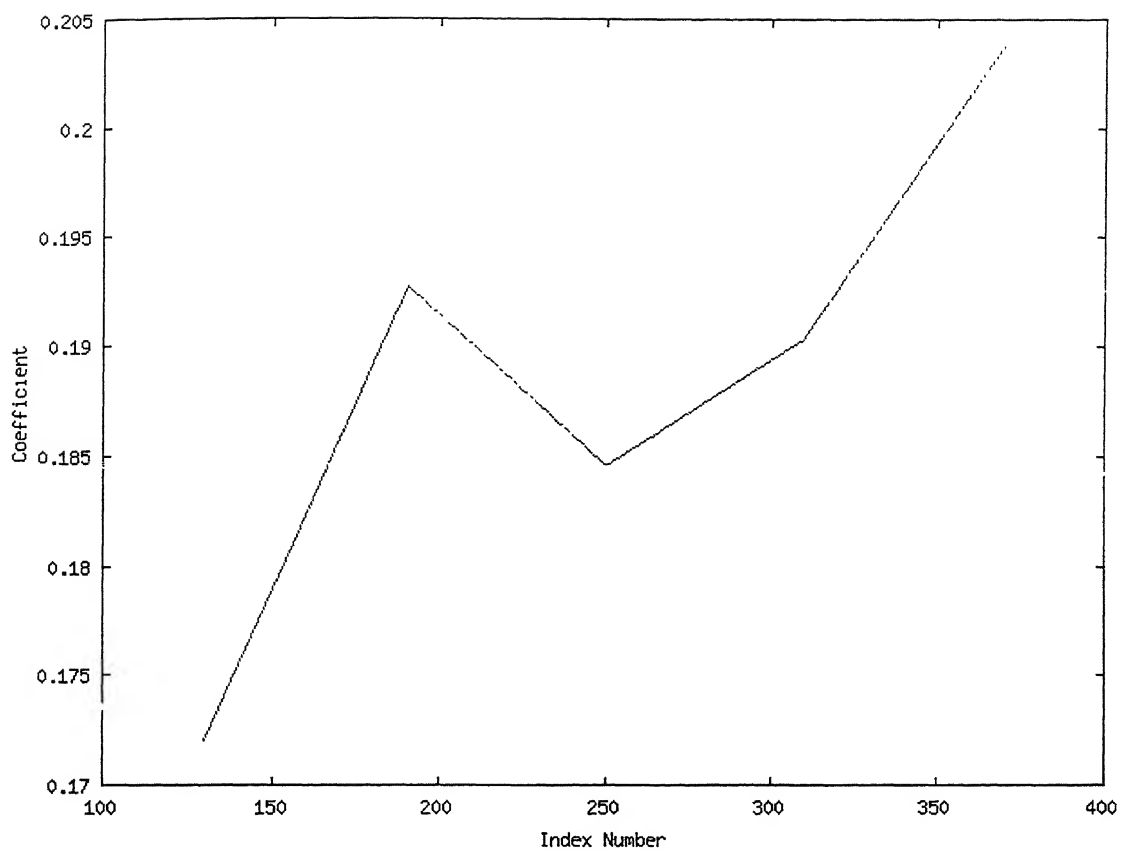


Fig 4.49 Variation of coefficient of C1 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

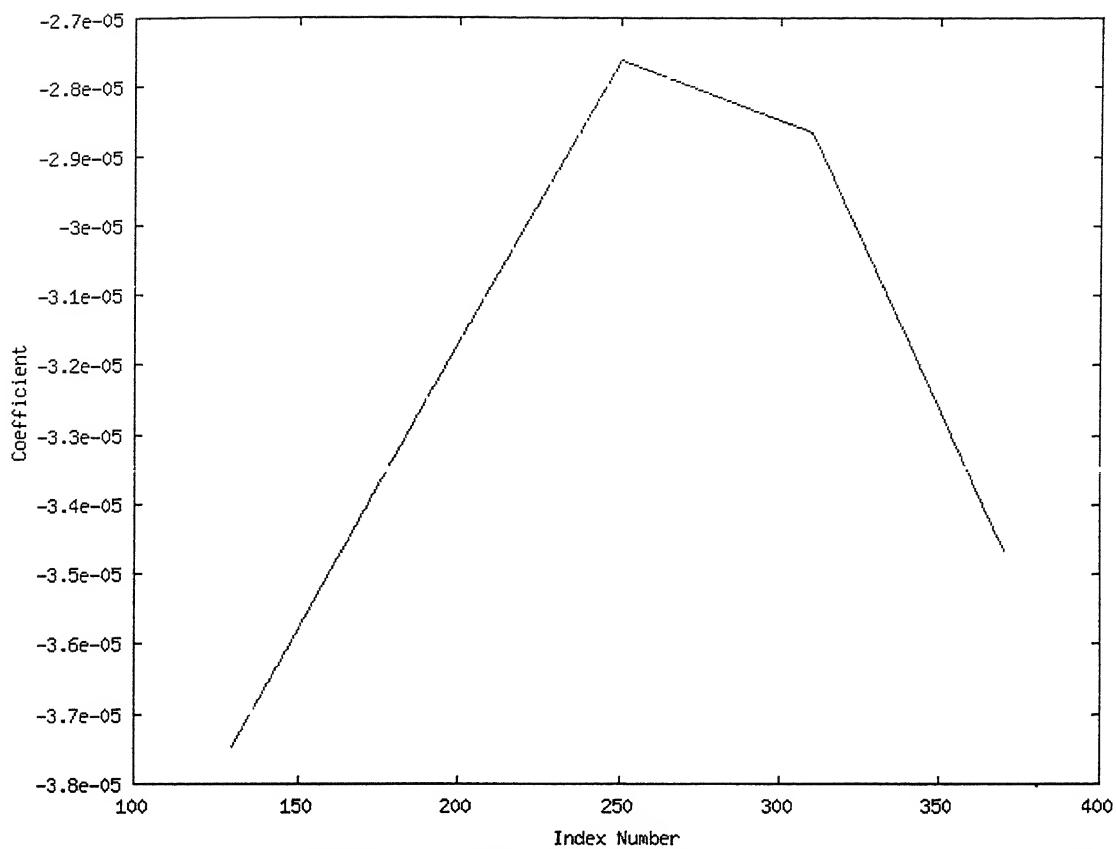


Fig 4.50 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)



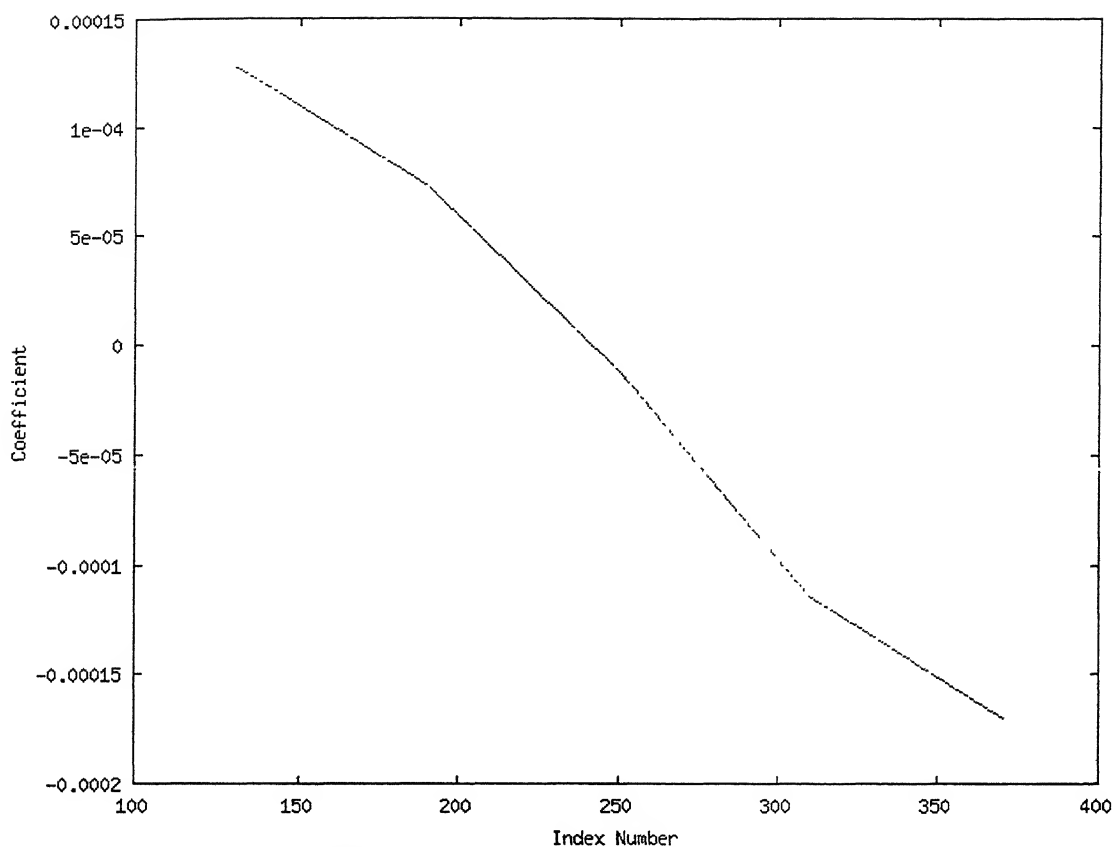


Fig 4.51 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

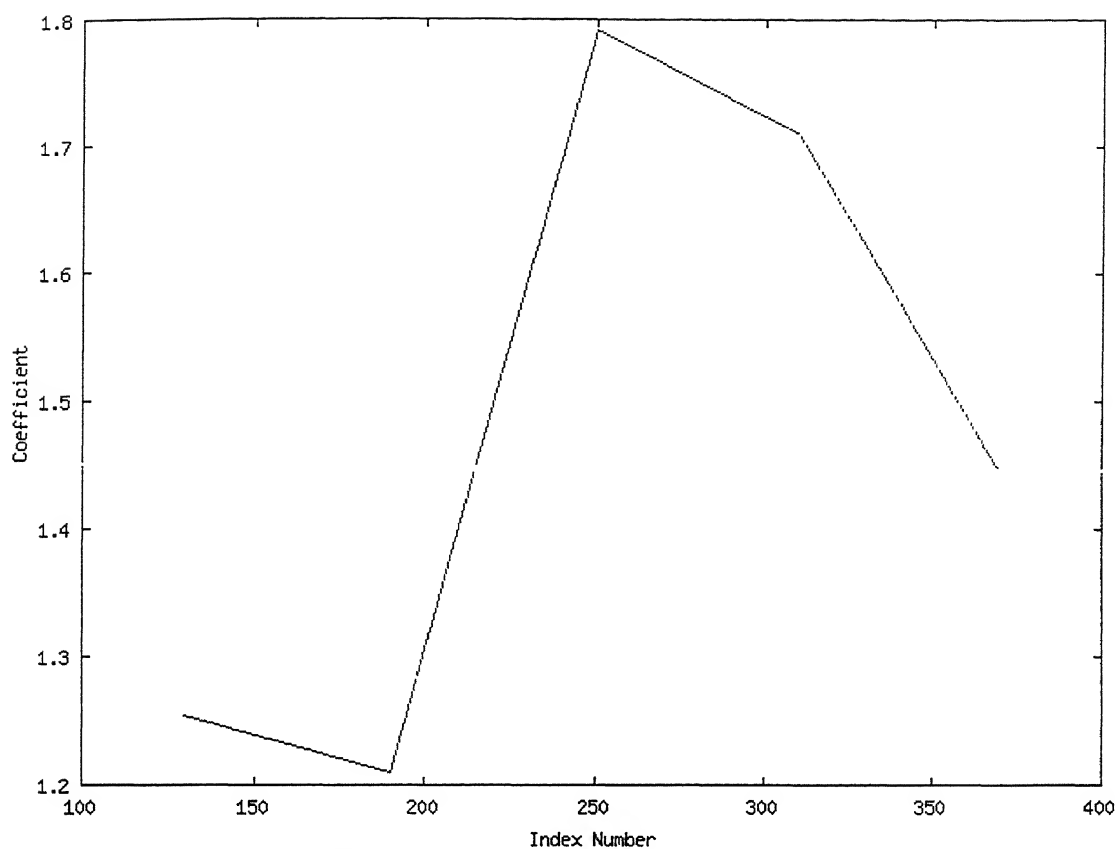


Fig 4.52 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

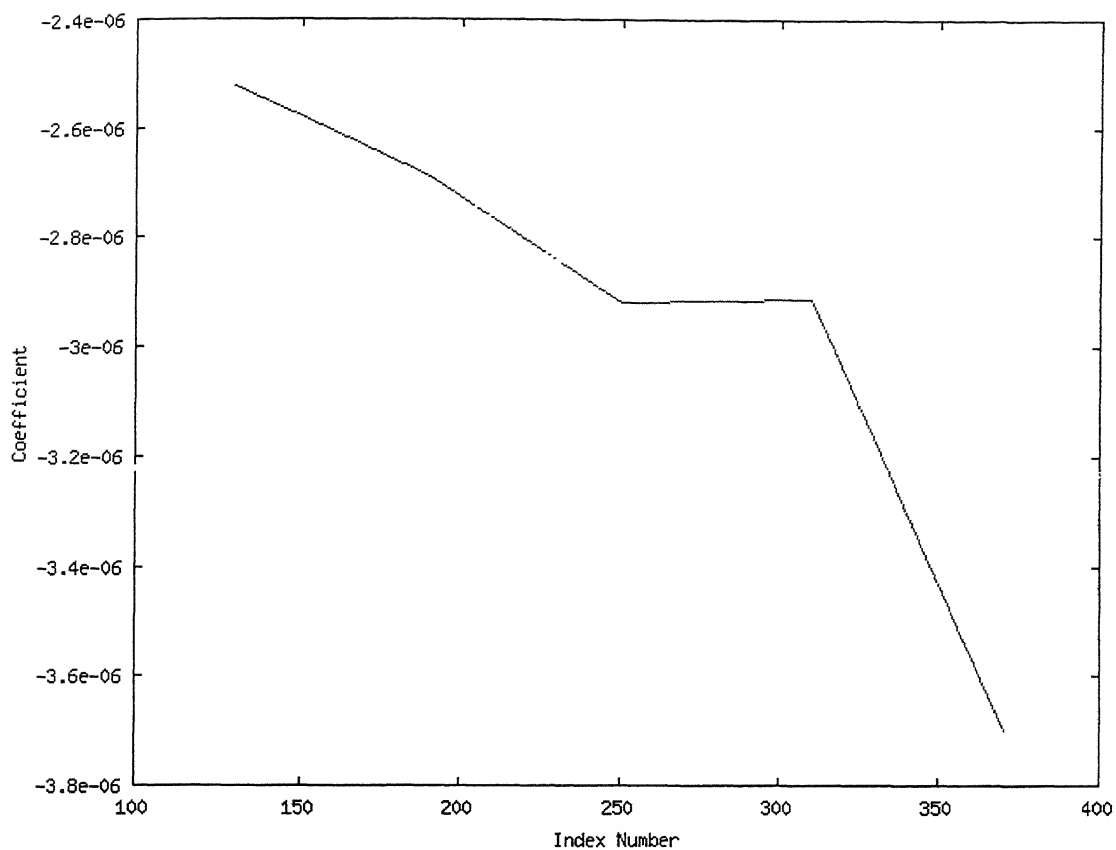


Fig 4.53 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

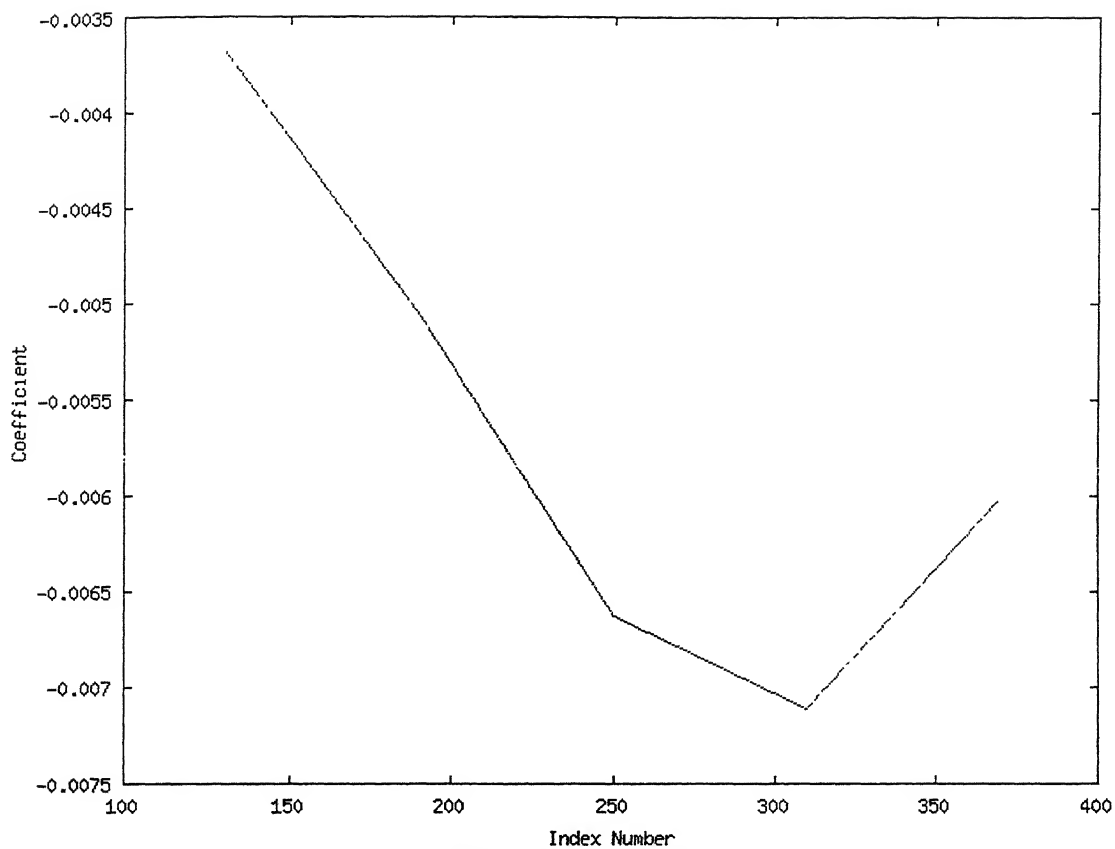


Fig 4.54 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

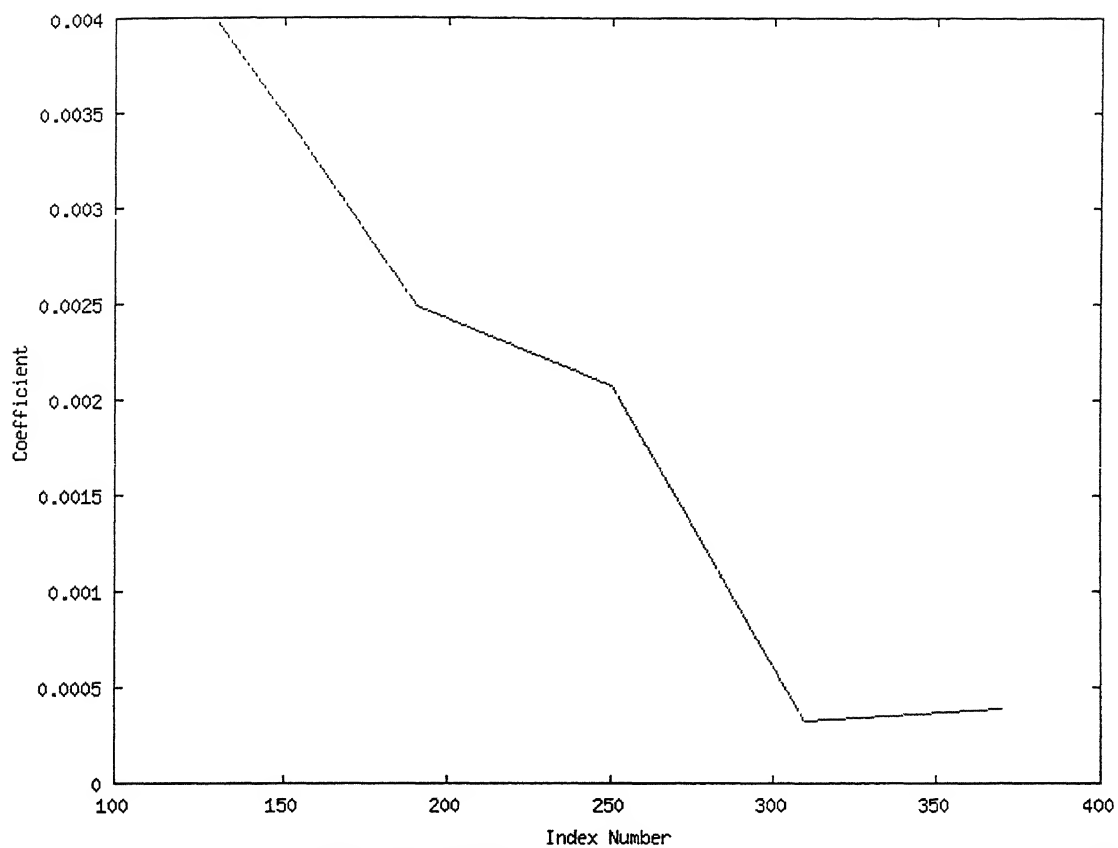


Fig 4.55 Variation of coefficient of BAS in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

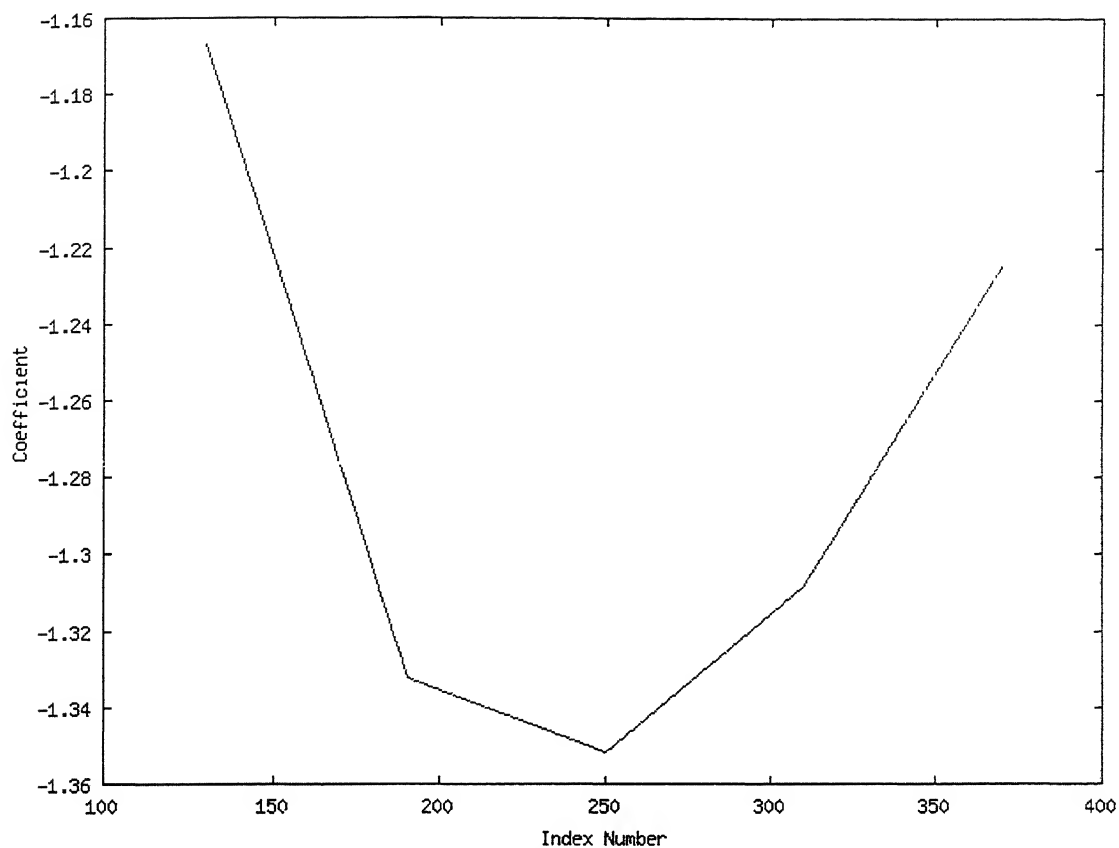


Fig 4.56 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for Mn<sub>2</sub> (For group 1 in which no RDOLO<sub>2</sub> and ORE<sub>2</sub> is added)

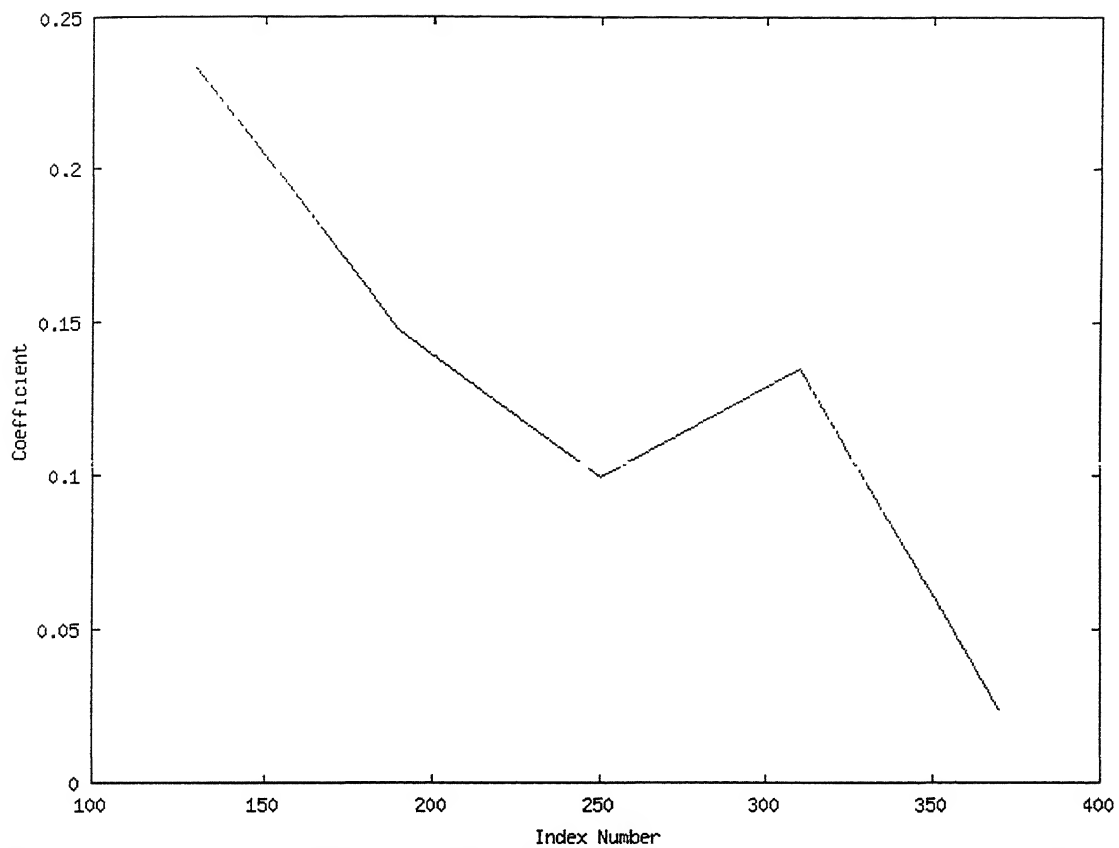


Fig 4.57 Variation of coefficient of P0 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

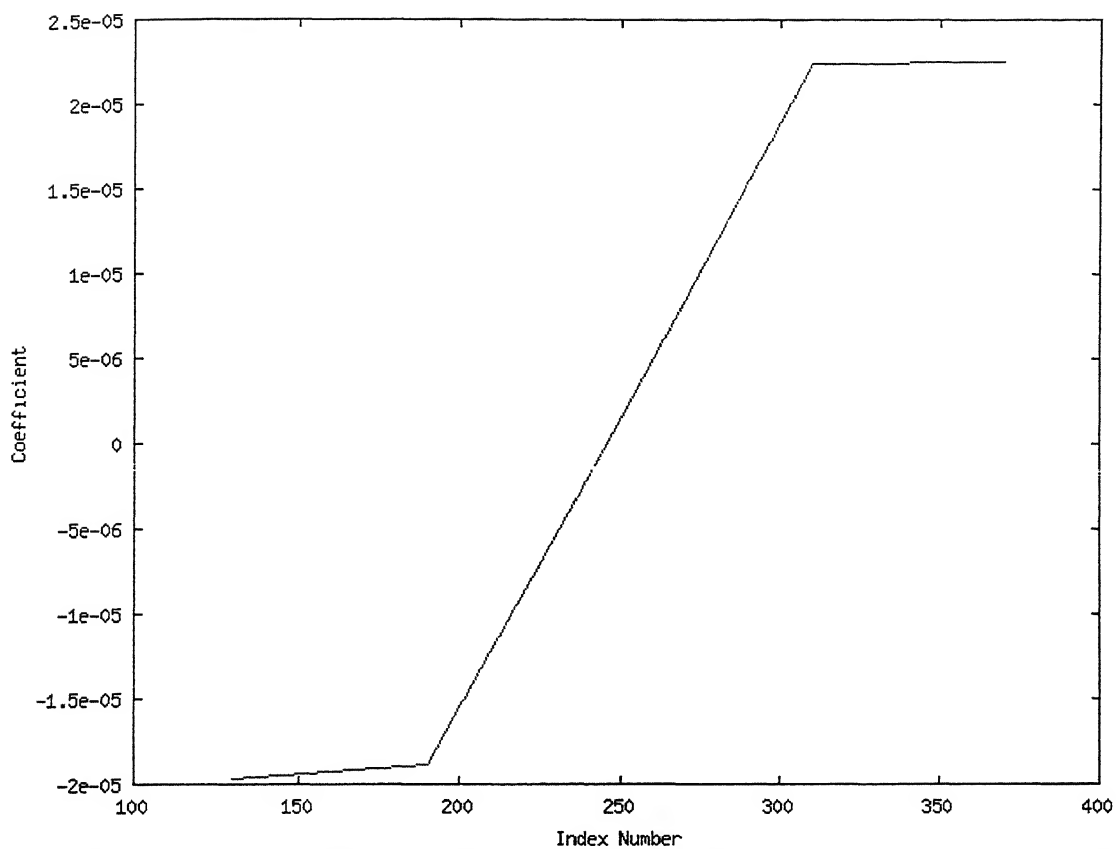


Fig 4.58 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)



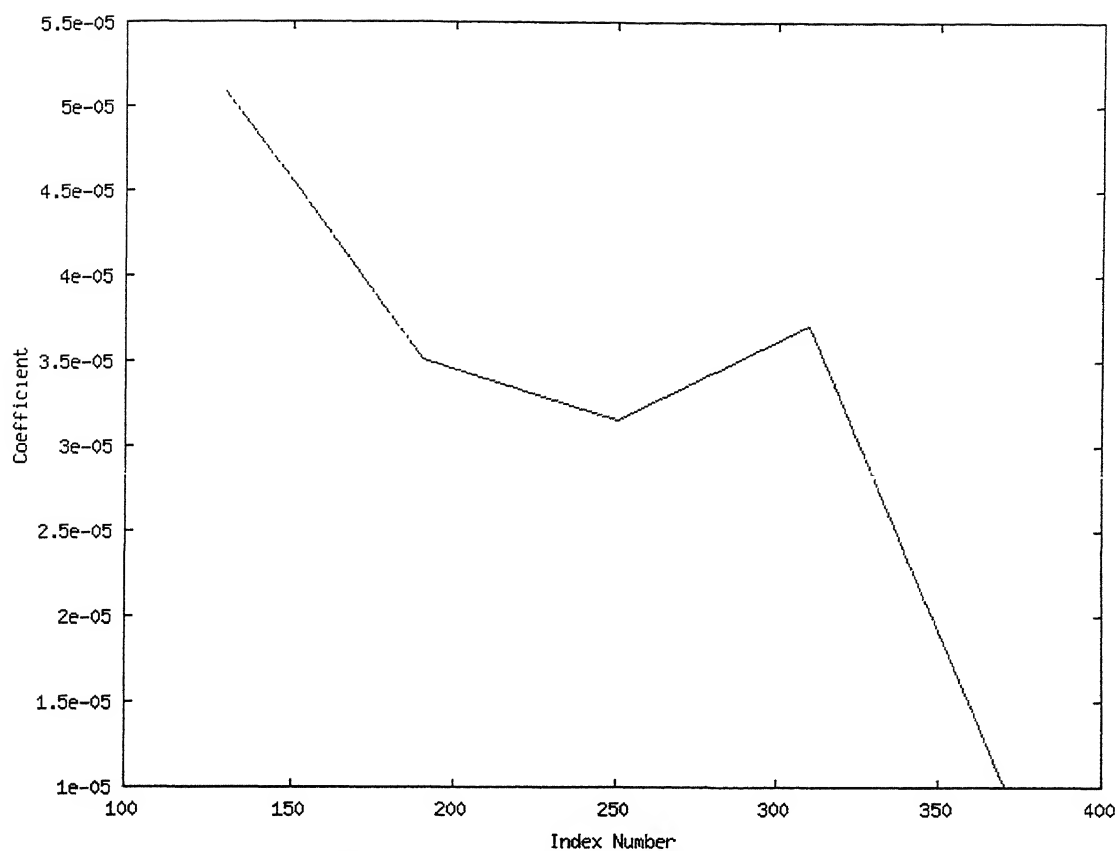


Fig 4.59 Variation of coefficient of T2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

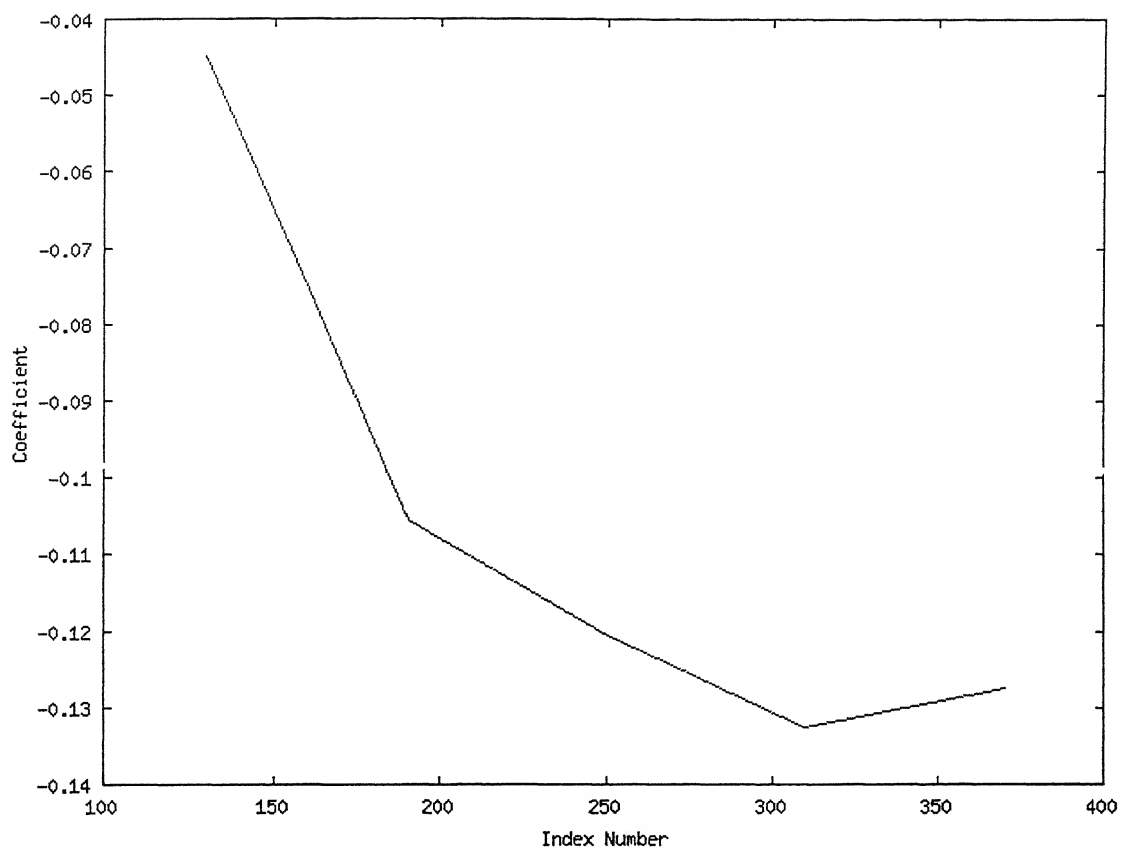


Fig 4.60 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

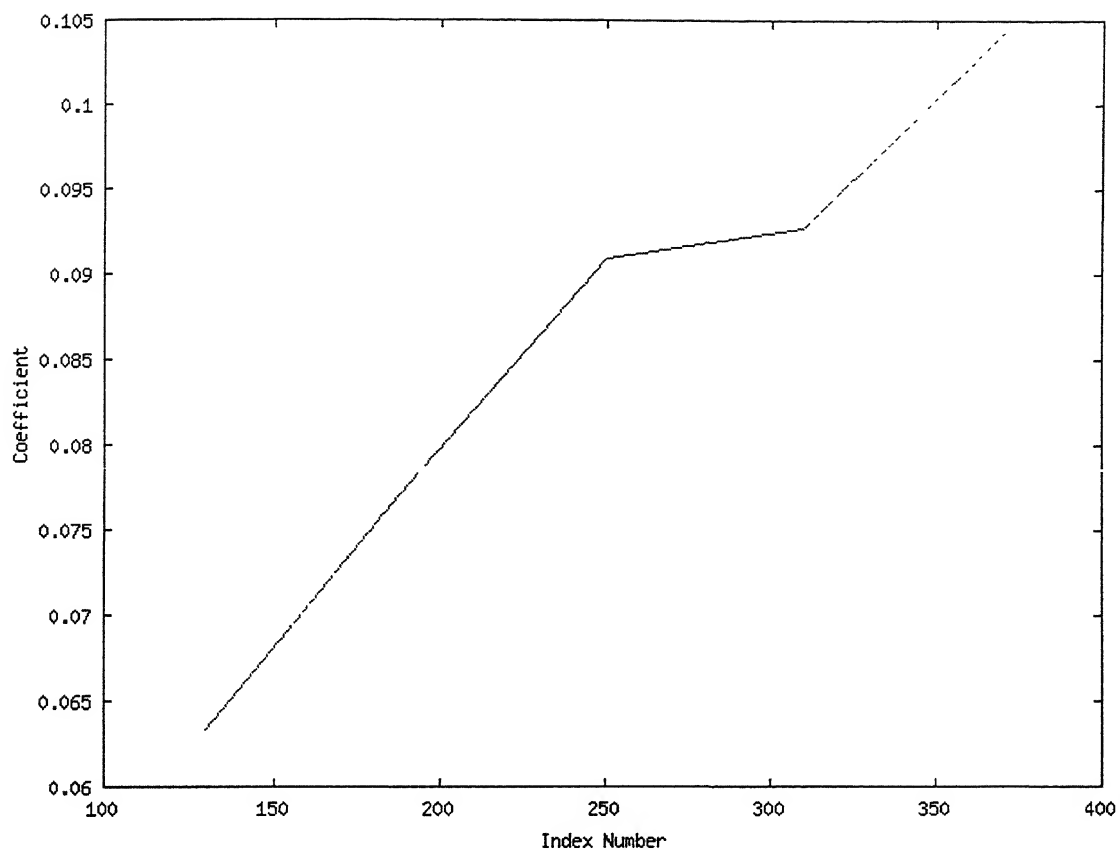


Fig 4.61 Variation of coefficient of Mn2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

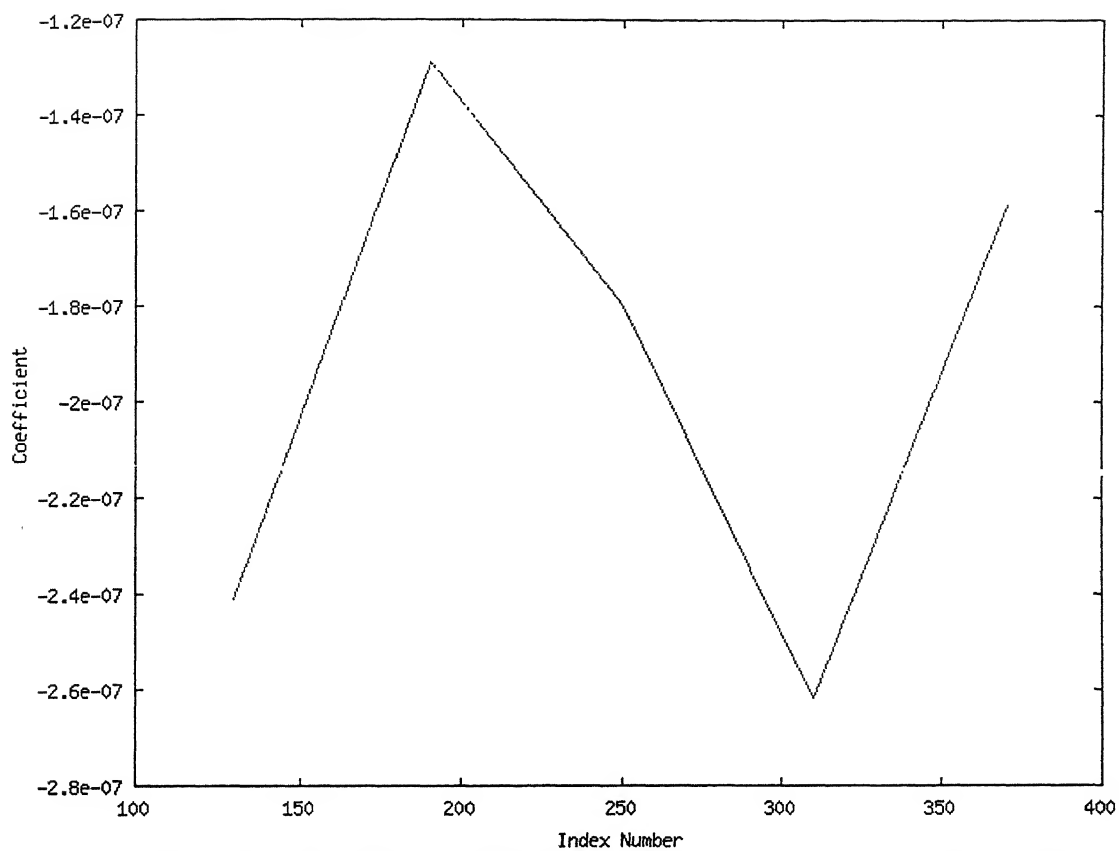


Fig 4.62 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

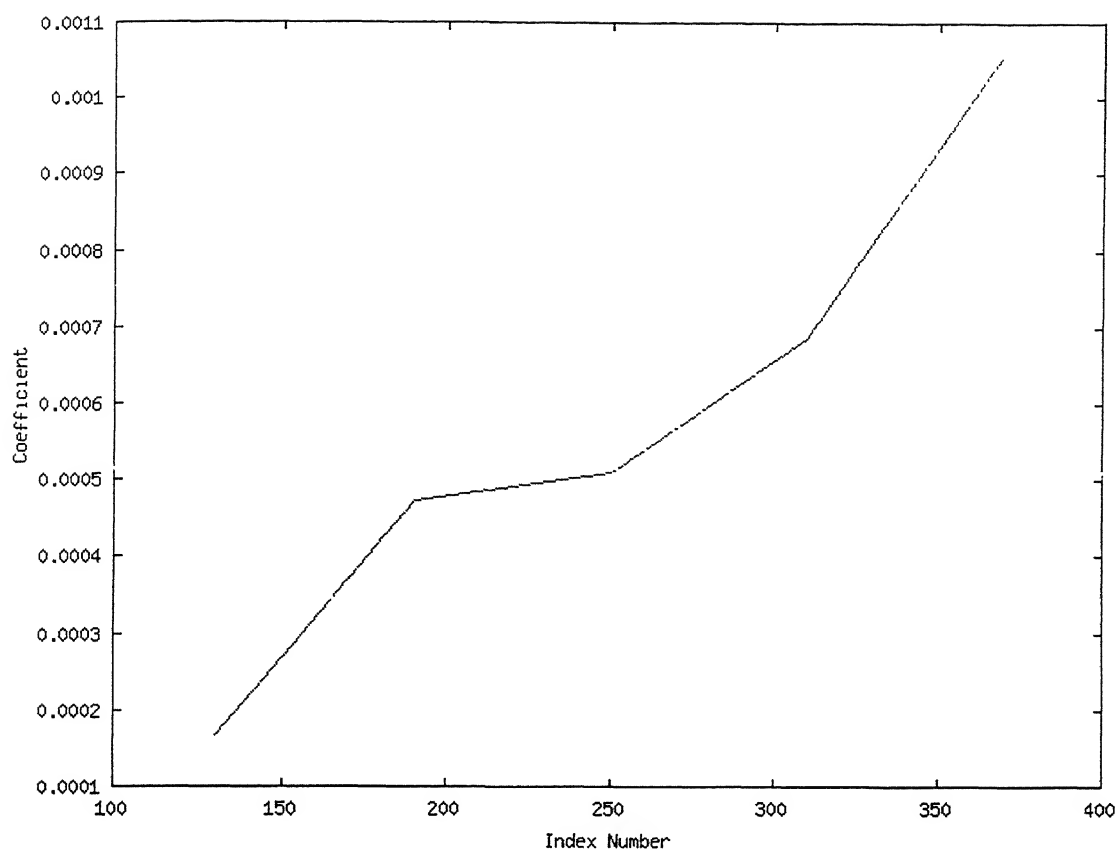


Fig 4.63 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

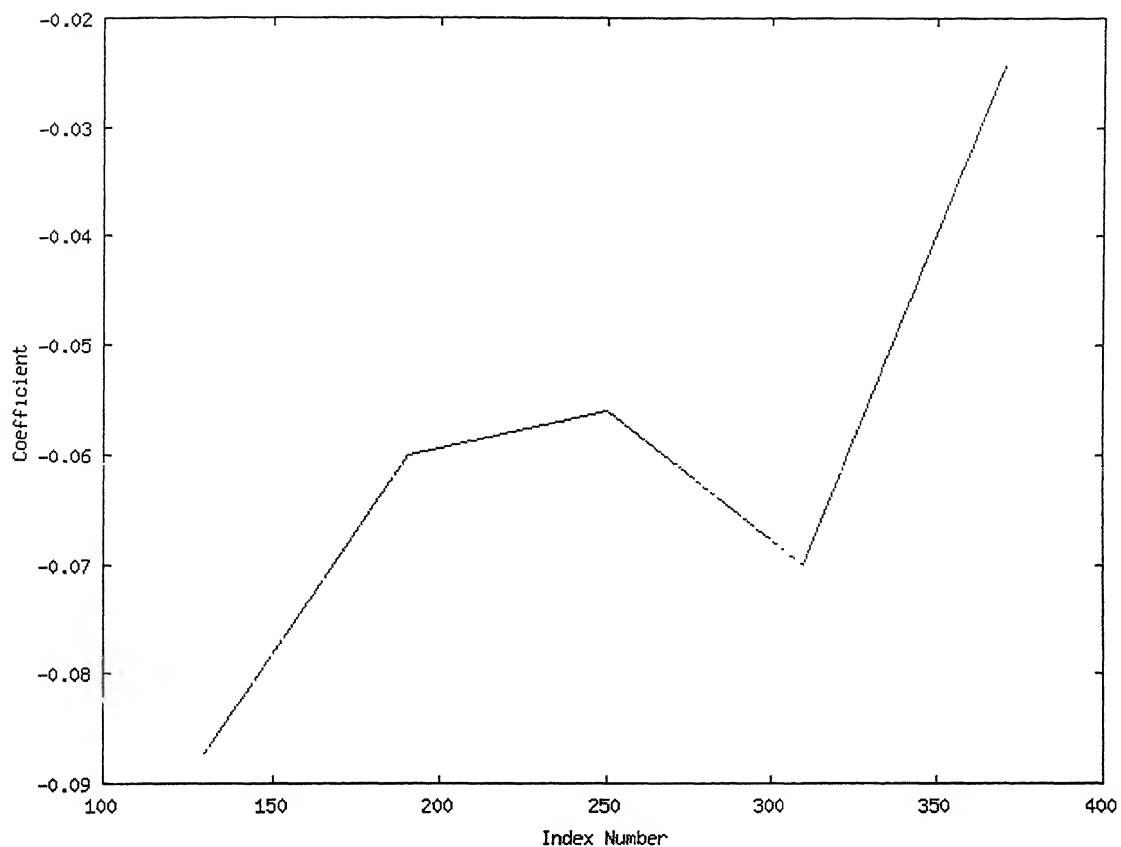


Fig 4.64 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOL02 and ORE2 is added)

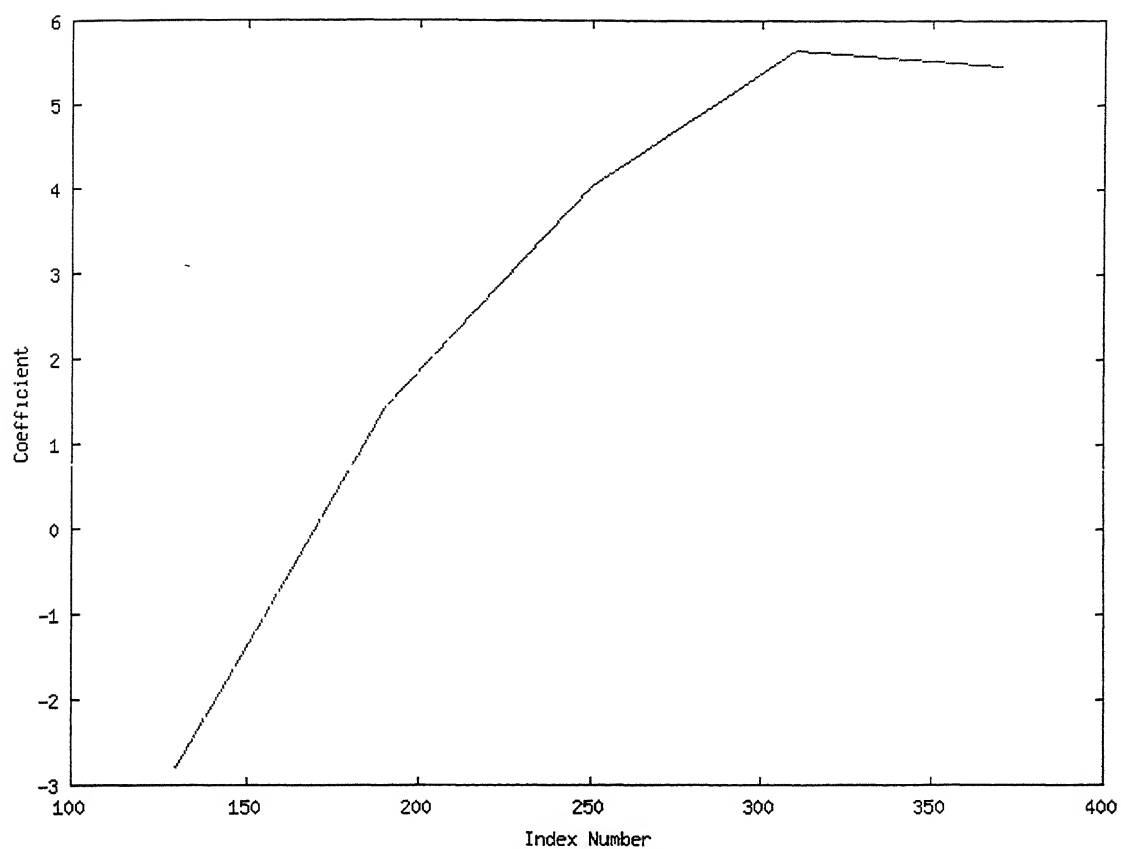


Fig 4.65 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)

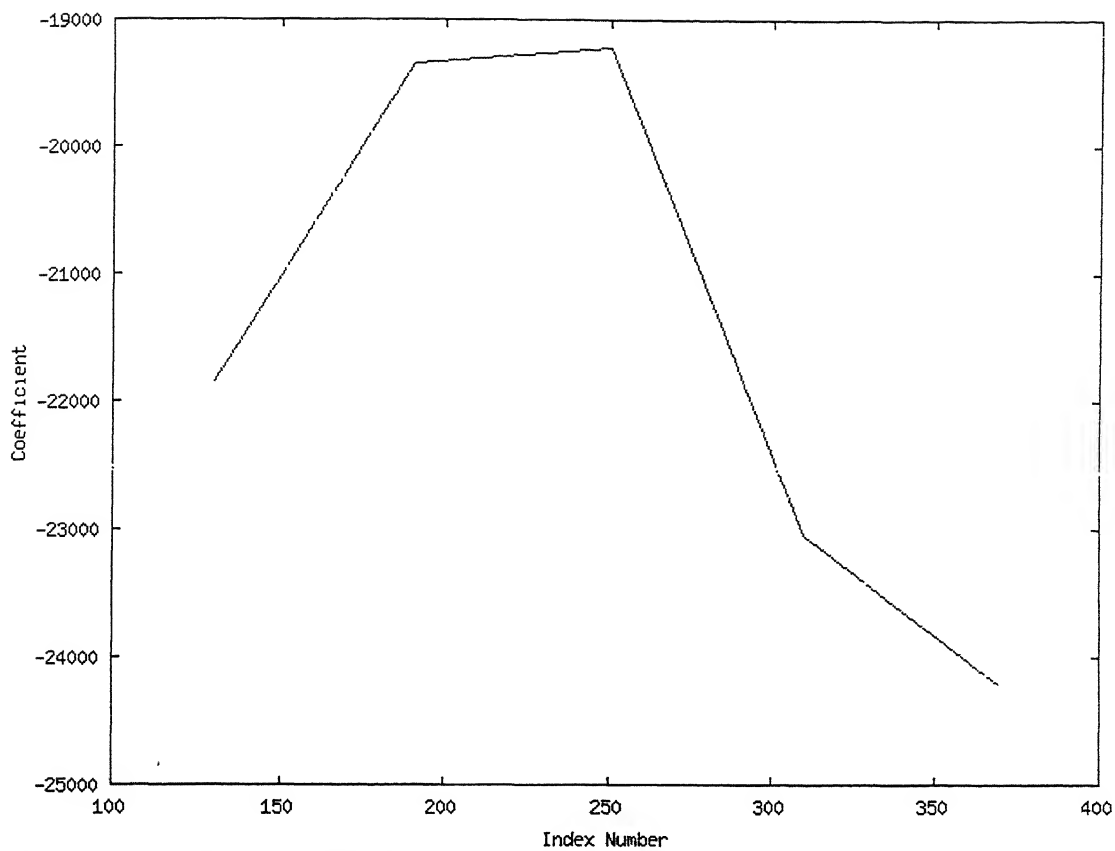


Fig 4.66 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)



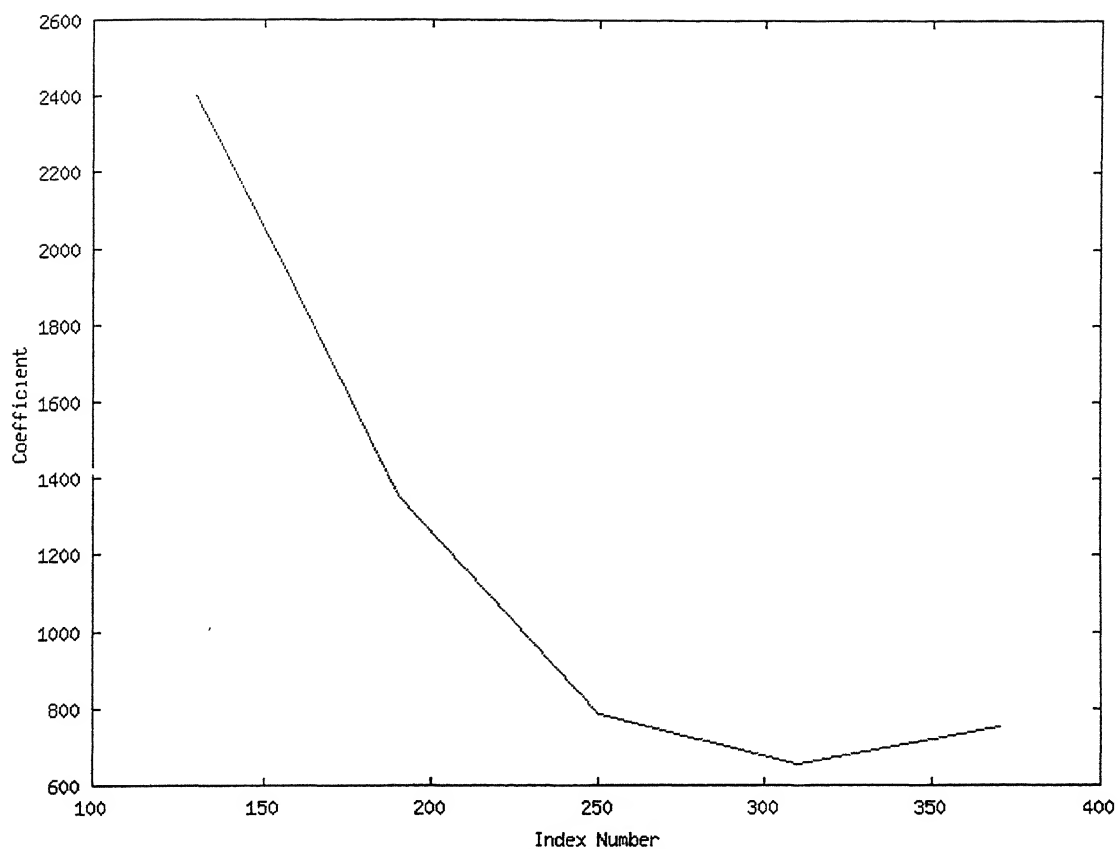


Fig 4.67 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)

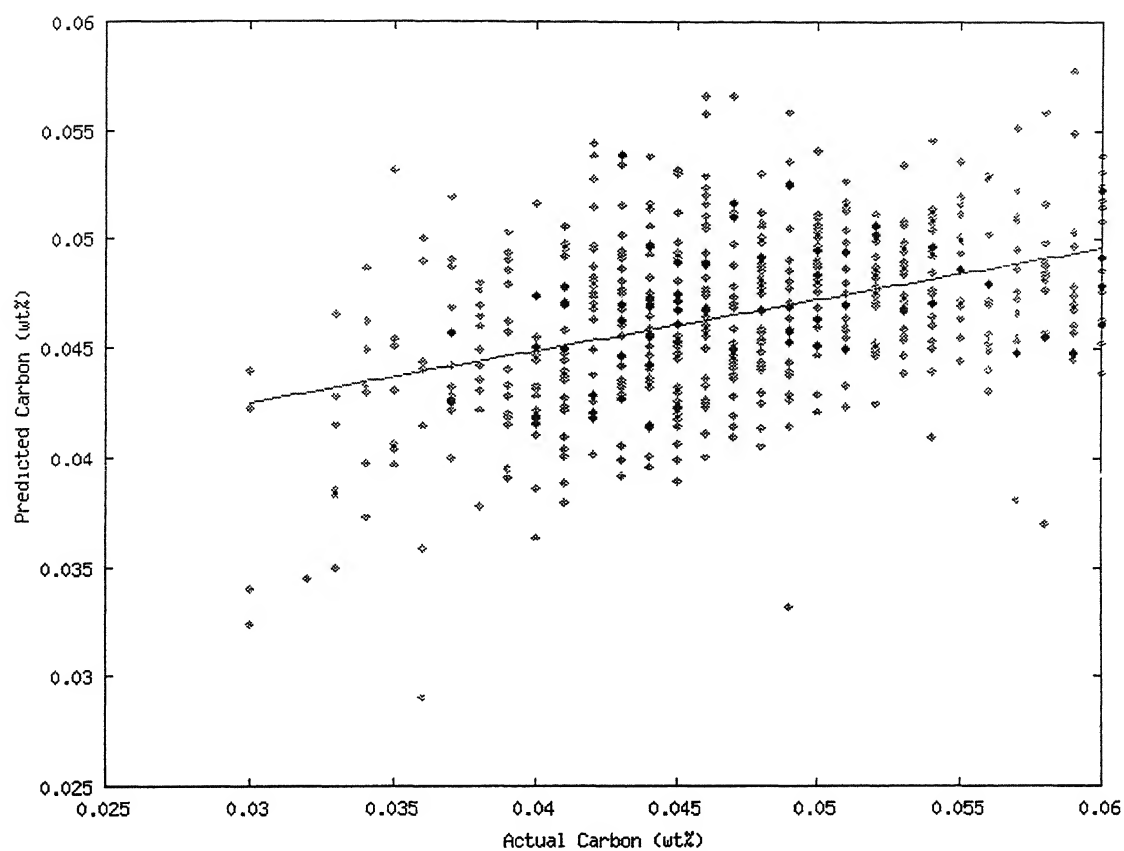


Fig 4.68 Prediction versus actual end point carbon using sequential linear prediction equations without sublance measurements (direct blow)

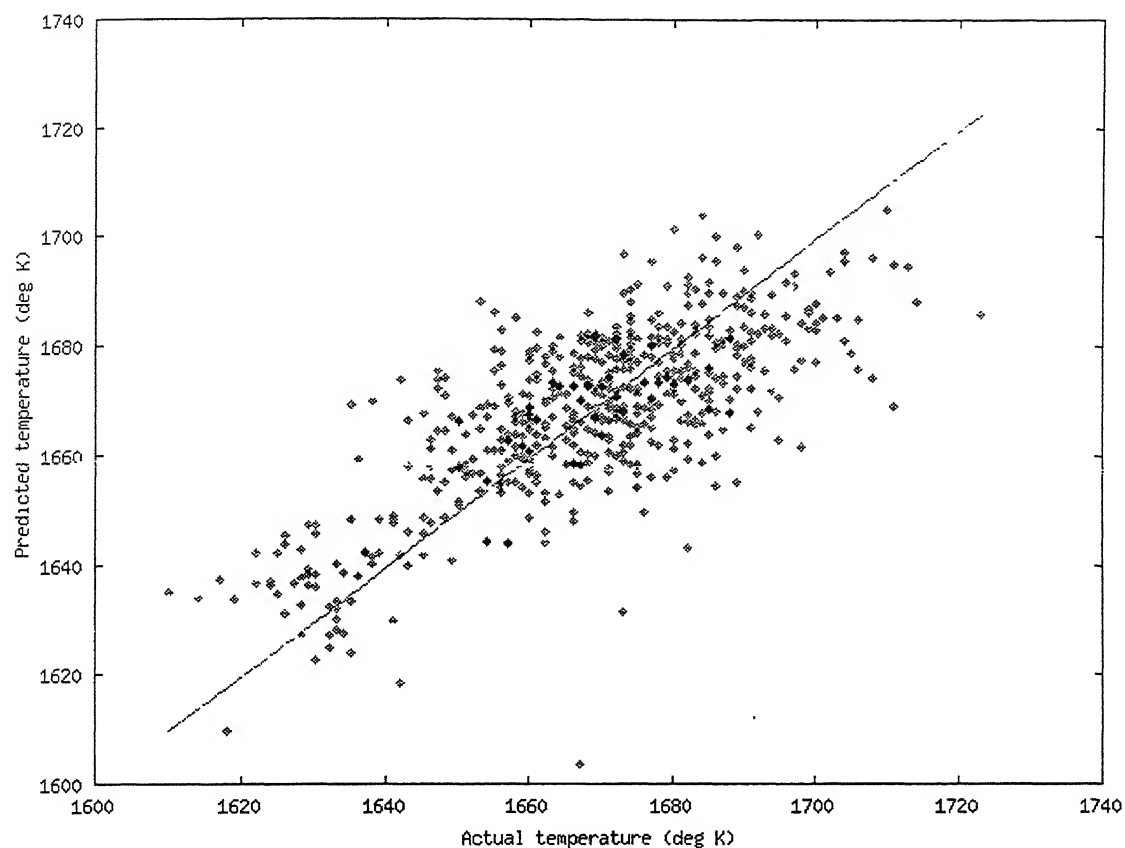


Fig 4.69 Prediction versus actual end point temperature using sequential linear prediction equations without substance measurements (direct blow)

Table 4.45 Coefficient of various terms in sequential linear prediction models for end point carbon (direct blow)

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5	RUN#6	RUN#7
WBATH	8.6000e-08	3.1000e-08	6.3000e-08	3.5000e-08	-2.020e-07	-6.000e-09	-1.160e-07
GRY	2.8400e-07	3.6800e-07	1.9600e-07	3.4100e-07	6.7400e-07	5.2700e-07	5.0400e-07
C0	1.7308e-02	1.8670e-02	2.3413e-02	2.1271e-02	2.4896e-02	1.8631e-02	1.8212e-02
Mn0	1.5699e-02	4.3443e-02	6.9163e-02	8.5847e-02	2.1168e-02	7.6526e-02	1.9938e-02
P0	-2.858e-01	-2.616e-01	-2.341e-01	-2.868e-01	2.1659e-01	-2.708e-01	5.2529e-01
Si0	1.5828e-02	1.9209e-02	2.1244e-02	1.3915e-02	1.3212e-02	9.0387e-03	-2.156e-03
HL2	2.1241e-05	1.6603e-05	-1.427e-05	1.3758e-05	5.7278e-05	5.7621e-05	-1.647e-06
HTR	-3.723e-04	-5.975e-04	1.6276e-03	1.9781e-04	-2.494e-03	-2.114e-03	-3.679e-03
ORE1+ORE2	-1.216e-06	-1.062e-06	-1.027e-06	-8.400e-07	-6.610e-07	-6.910e-07	-2.180e-07
RSL1+RSL2	9.9500e-07	1.1040e-06	-4.690e-07	-6.930e-07	-9.560e-07	-5.510e-07	-1.560e-07
RDOL01+RDOL02	7.0700e-07	3.8900e-07	-4.780e-07	3.8000e-07	1.7760e-06	1.2820e-06	1.1870e-06
O21+O22	-6.983e-06	-6.380e-06	-5.668e-06	-7.142e-06	-7.953e-06	-7.983e-06	-4.855e-06
CONSTANT	-3.625e-02	-7.222e-02	-7.877e-02	-7.851e-02	-1.011e-01	-8.544e-02	-9.013e-02

Table 4.46 Coefficient of various terms in sequential linear prediction models for end point temperature (direct blow)

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5	RUN#6	RUN#7
WBATH	-3.821e-05	6.1886e-05	1.9047e-04	1.1760e-04	3.0869e-04	2.6616e-04	2.7059e-04
GSCHROT	-9.993e-04	-1.209e-03	-1.583e-03	-1.399e-03	-2.238e-03	-2.065e-03	-1.497e-03
C0	7.2966e+01	9.9113e+01	7.9196e+01	9.2203e+01	9.0456e+01	1.0243e+02	9.7091e+01
Mn0	5.7163e+01	4.3136e+01	-3.120e+01	-4.409e+01	6.7197e+01	1.0601e+02	7.8285e+01
Si0	1.4644e+01	-1.826e+01	-1.731e+01	4.5350e+01	5.9006e+01	1.0464e+02	9.5853e+01
LNSLF	-4.634e-02	-2.413e-02	4.4404e-02	1.8745e-02	2.8328e-02	2.6809e-03	-1.502e-02
HL2	1.5350e-01	1.7111e-01	1.0074e-01	6.3755e-02	3.5432e-02	3.9518e-02	1.7729e-01
HTR	4.8939e+00	2.0952e+00	-3.602e+00	-7.813e-01	-6.642e+00	-2.851e+00	2.5544e+00
BAS	-5.601e+00	-6.948e+00	-3.971e+00	1.7784e+00	2.4727e+00	5.2906e+00	3.5254e+00
LIM1+LIM2	-3.314e-04	1.4343e-03	6.6827e-04	-1.382e-03	-1.705e-03	-2.314e-03	-2.411e-03
ORE1+ORE2	-4.117e-03	-4.854e-03	-3.577e-03	-4.344e-03	-4.452e-03	-4.623e-03	-3.927e-03
RSL1+RSL2	-9.577e-04	-2.795e-03	-2.885e-03	-3.152e-03	-1.999e-03	-1.269e-03	-2.110e-04
RDOL01+RDOL02	-3.407e-03	-3.476e-03	-3.830e-03	-5.459e-03	-6.474e-03	-5.867e-03	-3.954e-03
O21+O22	1.5527e-02	8.7018e-03	1.1084e-02	1.1685e-02	1.2653e-02	1.0458e-02	1.0521e-02
CONSTANT	1.1317e+03	1.1163e+03	1.2163e+03	1.1357e+03	1.0987e+03	1.0153e+03	9.6745e+02

## Chapter 5

### Results of intelligent model

#### 5.1 Introduction

We had earlier partitioned the dataset D1 into three groups based on the values of ORE2 and RDOLO2. First group contained heats in which neither ORE2 nor RDOLO2 were added. Second group contained heats containing RDOLO2 but no ORE2. Third group contained heats containing ORE2 but no RDOLO2. We have developed separate linear prediction equations for each group (Tables 4.1-4.15). When intelligent optimization model is applied to a particular heat, suitable linear prediction equations are inserted into the optimization model. Since linear prediction equations have been developed for three groups (as defined above) separately, the group to which the heat may belong should be known a priori. Thus, we can make any of the three assumptions about the group to which heat may belong and hence we can proceed with the optimization in three ways (or three options exist for the choice of control variables). Each option is to be evaluated in a separate optimization run.

##### 5.2.1 NO raw dolomite and ore option

It is ideal if no coolant additions are needed during the end blow period (i.e. neither ORE2 nor RDOLO2 is added). This constitutes the first option and for optimization purposes the linear prediction equations for group 1 are inserted within model. Tables 4.1, 4.4, 4.7, 4.10 and 4.13 give prediction equations for group 1 for the dataset D1. From these tables we conclude that control variables for group 1 of heats are O22, LIM2, DOLO2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

$$\text{Oxygen blown:} \quad 1100 \leq \text{O22} \leq 3600 \quad (5.1)$$

$$\text{Lime added:} \quad 0 \leq \text{LIM2} \leq 500 \quad (5.2)$$

$$\text{Dolomite added:} \quad 0 \leq \text{DOLO2} \leq 2000 \quad (5.3)$$

$$\text{Permissible lance height range} \quad 140 \leq \text{HL2} \leq 250 \quad (5.4)$$

These limits for control variables are determined from operational practice at the plant.

### ***5.2.2 Raw dolomite addition option***

If assume that no ORE2 but some RDOLO2 may be added, the result of optimization constitutes the second option. In this case, we should insert the linear prediction equations developed for group 2 into the optimization model. Tables 4.2, 4.5, 4.8, 4.11 and 4.14 give prediction equations for group 2 for the dataset D1. From these tables we conclude that control variables for group 2 of heats are O22, LIM2, DOLO2, RSL2, RDOLO2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

$$\text{Oxygen blown} \quad 1100 \leq \text{O22} \leq 3600 \quad (5.5)$$

$$\text{Lime added} \quad 0 \leq \text{LIM2} \leq 500 \quad (5.6)$$

$$\text{Dolomite added} \quad 0 \leq \text{DOLO2} \leq 2000 \quad (5.7)$$

$$\text{Return slag added} \quad 0 \leq \text{RSL2} \leq 2500 \quad (5.8)$$

$$\text{Raw dolomite added} \quad 0 \leq \text{RDOLO2} \leq 4000 \quad (5.9)$$

$$\text{Permissible lance height range} \quad 140 \leq \text{HL2} \leq 250 \quad (5.10)$$

As in the case of first option, these limits for control variables are determined from operational practice at the plant.

### ***5.2.3 Ore addition option***

If we assume that no RDOLO2 but some ORE2 may be added the result of optimization constitutes the third option. In this case, we should insert the linear prediction equations developed for group 3 into the optimization model. Tables 4.3, 4.6, 4.9, 4.12 and 4.15 give prediction equations for the dataset D1. From these tables, we conclude that control variables for group 3 of heats are O22, LIM2, DOLO2, ORE2, RSL2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

$$\text{Oxygen blown} \quad 1100 \leq \text{O22} \leq 3600 \quad (5.11)$$

$$\text{Lime added} \quad 0 \leq \text{LIM2} \leq 500 \quad (5.12)$$

$$\text{Dolomited added} \quad 0 \leq \text{DOLO2} \leq 2000 \quad (5.13)$$

$$\text{Ore added} \quad 0 \leq \text{ORE2} \leq 1400 \quad (5.14)$$

$$\text{Return slag added} \quad 0 \leq \text{RSL2} \leq 2500 \quad (5.15)$$

$$\begin{aligned} \text{Permissible lance height range} \\ 140 \leq \text{HL2} \leq 250 \end{aligned} \quad (5.16)$$

Like the other two options, these limits on control variables are determined from the operational practices at the plant.

## ***5.3 Results of intelligent model for different options***



The results of intelligent model on the dataset D1 are summarized in the Table A5.1 (presented in Appendix 5). For this dataset the aim values were taken to be the actual values. The table has four rows for each heat. First row gives the heat number, actual composition and actual values of process parameters. Second to fourth rows give the three options suggested by the intelligent model. Suggested process parameters and predicted composition values are given. Violations, if any, are also reported and the cost is also given. Violations are reported if the deviation from the window boundary exceeds certain limits, which are reported in Table 5.1. The results of intelligent model on the dataset D2, which contains aim values also, are summarized in the Table A5.2 (presented in Appendix 5). This table is similar to the Table A5.1 but it also contains a row for aim values for each heat.

### ***5.3.1 Results of intelligent model on dataset D1***

The dataset D1 did not contain any aim values thus we used actual values as aim values. Linear models developed for different groups in D1, as explained in Table 5.2, were used as control equations to predict carbon, temperature, manganese, phosphorus and dissolved oxygen. As discussed in chapter 4, the prediction equations are valid only if actual end point carbon is less than 0.06 wt%, so in each group we considered only those heats for which actual carbon was less than 0.06 wt%. The cost function, used was the same as described in chapter 2. The deviations from aim values (in this case actual values) are plotted in Figs 5.1-5.5. The costs for lowest cost options are given in Fig 5.6. It was found that in 17% cases only, the lowest cost option was the first option while in 39% cases the lowest cost option was the second option and in 44% cases the lowest cost option was the third option. It can be explained that in first option, there are only 4 controlling variables, while in second and third option; there are 6 controlling variables. Thus second and third options have more degrees of freedom in optimization than the first one and hence we usually get lower costs in second and third option than the first option.

### ***5.3.1.1 Carbon window of dataset D1***

Deviations of optimized predicted carbon from actual carbon are shown in Fig 5.1. Figure also shows the carbon window. Only for heat number 1801 the carbon window is violated by an amount greater than 0.0004%. For 127 heats the deviation is positive and for 146 heats the deviation is negative.

### ***5.3.1.2 Temperature window of dataset D1***

Deviations of optimized predicted temperature from actual temperature for lowest cost option are shown in Fig 5.2. Figure also shows the upper and lower limits of temperature window. Violations occur for heat numbers 1755, 2078, 2131, 2178, 2365, and 2499. For 196 heats the deviation is negative while the deviation is positive only for 77 heats. All the violations occur on the lower limit of window. This may be attributed to the fact that model actively uses various conditioners such as DOLO2, LIM2, etc to control the end point window while in current operating practice these conditioners are used sparingly. In 122 heats, suggested LIM2 is greater than 100 kg while in actual heats LIM2 exceeds 100 kg, only in 12 cases. For example in heat number 1739 suggested LIM2 is 400 Kg while in actual heat, there was no LIM2 added. Similar is the case with other additions. Thus, predicted temperature is lower in most of the cases but lies within the control window. In this way, costs arising due to other variables were reduced at the cost of temperature deviation from aim value within the window. Further it was found that for these heats, which violated the temperature window the difference between end point temperature and substance temperature was higher than average heats. Due to high actual end point temperature relative to substance temperature, predicted temperature fell short of actual temperature.

### ***5.3.1.3 Manganese window of dataset D1***

Deviations of optimized predicted manganese from actual manganese for lowest cost option are shown in Fig 5.3. Figure also shows the upper limit of manganese window. There is no lower limit on manganese window. All the deviations lie in the window and

there is no case of violation. Most of the times predicted manganese is below actual manganese. This is explained by the fact that in 225 heats, suggested O22 is greater than the actual O22 while in only 46 heats, suggested O22 is less than the actual O22.

#### ***5.3.1.4 Phosphorus window of dataset D1***

Deviations of optimized predicted phosphorus from actual phosphorus for lowest cost option are shown in Fig 5.4. Figure also shows the upper limit of phosphorus deviation, which is 0 deviation line since upper limit of phosphorus is the actual phosphorus. Violation of window occurs only for one heat, number 2446.

#### ***5.3.1.5 Dissolved oxygen window of dataset D1***

Deviations of optimized predicted dissolved oxygen from actual dissolved oxygen for lowest cost option are shown in Fig 5.5. Figure also shows the upper and lower limits of dissolved oxygen window. In none of the heats the violation from the window limit exceeds 10 ppm, so no violations are reported. The deviations are on the both sides of actual, just like the case with carbon window.

#### ***5.3.1.6 Percent direct hits for dataset D1***

A direct hit is said to occur if all end point variables, i.e. carbon, temperature, phosphorus, manganese, dissolved oxygen don't violate their respective windows. In case of dataset D1, violations occur only in heat numbers 1755, 1801, 2078, 2131, 2178, 2365, 2446 and 2499. Thus we get 265 direct hits out of total 273 heats. Thus percent direct hits for dataset D1 is 97%. Based on this percent direct hits value we can conclude that our optimization model performs fairly well on the dataset D1.

### ***5.3.2 Results of intelligent model on dataset D2***

Sequential linear prediction models as explained in Table 5.3, were used as control equations to predict carbon, temperature, manganese, phosphorus and dissolved oxygen. As discussed in chapter 4, the prediction equations are valid only if actual end point carbon is less than 0.06 wt%, so in each group we considered only those heats for which actual carbon was less than 0.06 wt%. The cost function, used was the same as described in chapter 2. The deviations from aim values (in this case actual values) are plotted in Figs 5.7-5.11. The costs for lowest cost options are given in Fig 5.12.

#### ***5.3.2.1 Carbon window of dataset D2***

Deviations of optimized predicted carbon from actual carbon are shown in Fig 5.7. Figure also shows the carbon window. For no heat carbon window is violated by an amount greater than 0.0004%. For 107 heats the deviation is positive and for 76 heats the deviation is negative. We observe a inclination towards positive deviation. This can be explained if we observe the aim values and actual values of manganese and phosphorus. These aim values are much higher than actual values. Thus to achieve higher manganese and phosphorus aim the model tries to cut down the oxygen blown and this causes a positive deviation in carbon.

#### ***5.3.2.2 Temperature window of dataset D2***

Deviations of optimized predicted temperature from actual temperature for lowest cost option are shown in Fig 5.8. Figure also shows the upper and lower limits of temperature window. Violations occur for heat numbers 2858, 2866, 2872 and 2887. For 109 heats the deviation is negative while the deviation is positive only for 74 heats and for positive deviation heats, the deviations are very small. All the violations occur on the lower limit of window. This inclination toward negative deviation in temperature has been explained in section 5.3.2.2.

#### ***5.3.2.3 Manganese window of dataset D2***

Deviations of optimized predicted manganese from actual manganese for lowest cost option are shown in Fig 5.9. Figure also shows the upper limit of manganese window. There is no lower limit on manganese window. All the deviations lie in the window and there is no case of violation. Most of the times predicted manganese is below actual manganese. This is because aim manganese is quite higher than actual manganese in most of the heats.

#### ***5.3.2.4 Phosphorus window of dataset D2***

Deviations of optimized predicted phosphorus from actual phosphorus for lowest cost option are shown in Fig 5.10. Figure also shows the upper limit of phosphorus deviation, which is 0 deviation line since upper limit of phosphorus is the actual phosphorus. Violation of window does not occur for any heat.

#### ***5.3.2.5 Dissolved oxygen window of dataset D2***

Deviations of optimized predicted dissolved oxygen from actual dissolved oxygen for lowest cost option are shown in Fig 5.11. Figure also shows the upper and lower limits of dissolved oxygen window. In none of the heats the violation from the window limit exceeds 10 ppm, so no violations are reported.

#### ***5.3.2.6 Percent direct hits for dataset D2***

A direct hit is said to occur if all end point variables, i.e. carbon, temperature, phosphorus, manganese, dissolved oxygen don't violate their respective windows. In case of dataset D2, violations occur only in heat numbers 2858, 2866, 2872 and 2887. Thus we get 179 direct hits out of total 183 heats. Thus, percent direct hits for dataset D1 is 97.8%. Based on this percent direct hits value we can conclude that our optimization model performs fairly well on the dataset D2..

Table 5.1  
Reporting of violation of constraints for each of the variable

Variable	Violation limit
[C]	0.0004 %
T	1 <sup>o</sup> C
[Mn]	0.001 %
[P]	0.0001 %
[O]	10 ppm

Table 5.2 Summary of prediction equations used for optimizing heats of dataset D1

Option	ORE2	RDOLO2	Dataset used	Prediction Equation
Option 1: No raw dolomite and ore option	NO	NO	Dataset D1, Group 1 (Appendix 4)	Tables 4.1, 4.4, 4.7, 4.10,4.13
Option 2: Raw dolomite addition option	NO	YES	Dataset D1, Group 2 (Appendix 4)	Tables 4.2, 4.5, 4.8, 4.11,4.14
Option 3: Ore addition option	YES	NO	Dataset D1, Group 3 (Appendix 4)	Tables 4.3, 4.6, 4.9, 4.12,4.15

Table 5.3 Summary of prediction equations used for optimizing heats of dataset D2

Option	ORE2	RDOLO2	Dataset used	Prediction Equation
Option 1: No raw dolomite and ore option	NO	NO	Dataset D2, Group 1 (Appendix 4)	Tables 4.25, 4.26, 4.27, 4.28,4.29
Option 2: Raw dolomite addition option	NO	YES	Dataset D2, Group 2 (Appendix 4)	Tables 4.30, 4.31, 4.32, 4.33,4.34
Option 3: Ore addition option	YES	NO	Dataset D2, Group 3 (Appendix 4)	Tables 4.35, 4.36, 4.37, 4.38,4.39

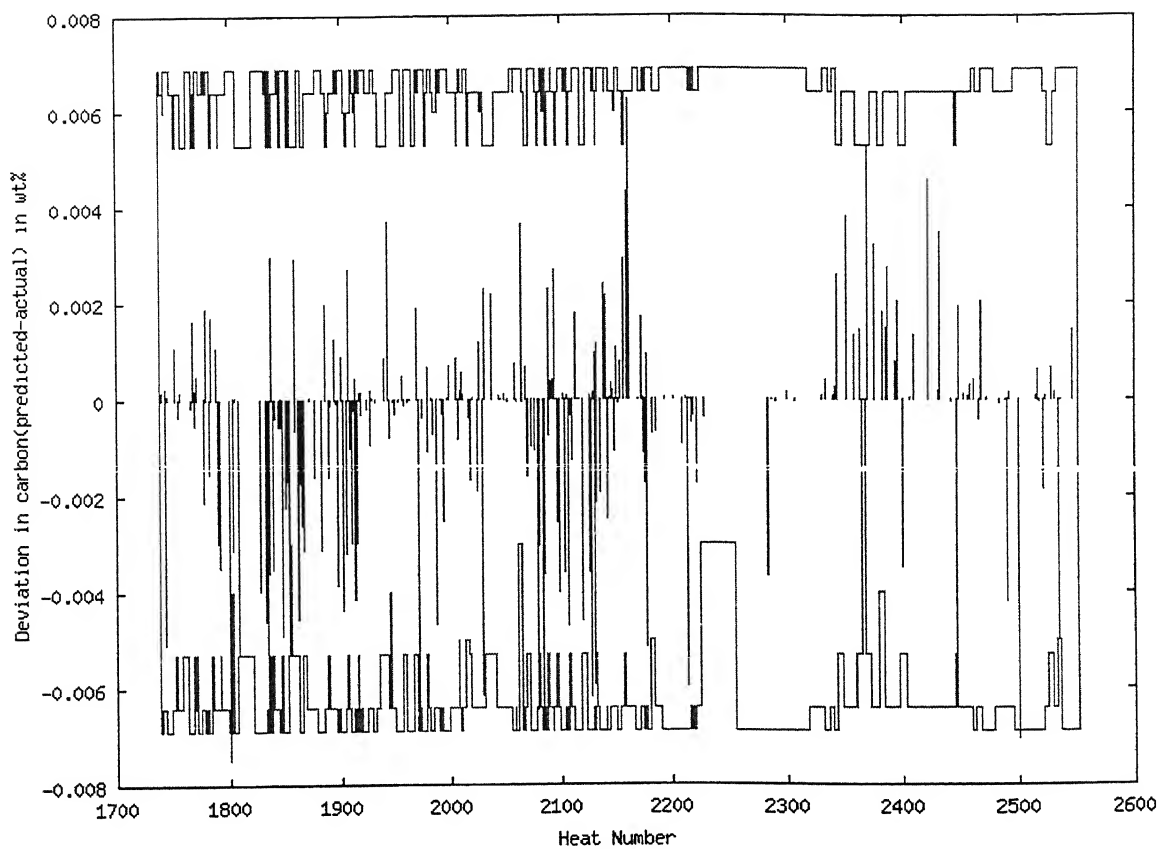


Fig 5.1 Carbon deviation (wt%) versus heat number for lowest cost option for dataset D1.  
Carbon window is also shown

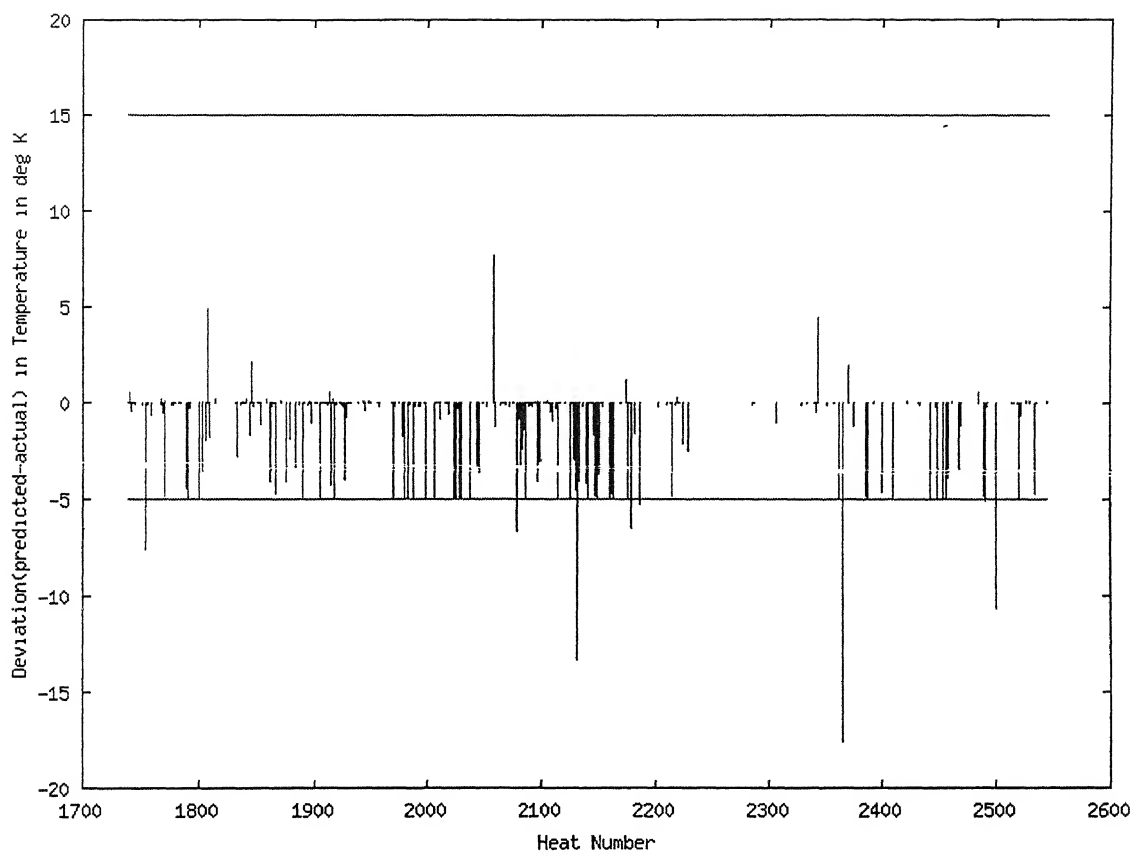


Fig 5.2 Temperature deviation (degree) versus heat number for lowest cost option for dataset D1. Temperature window is also shown.



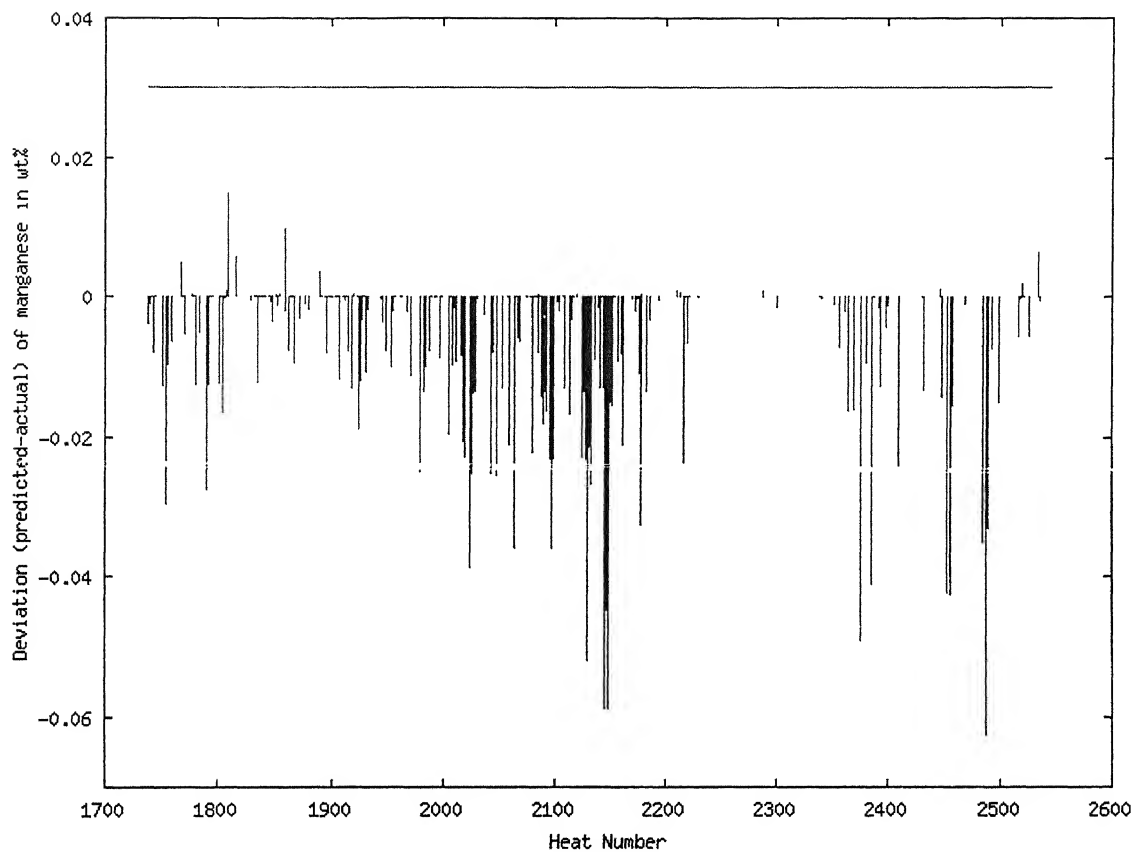


Fig 5.3 Manganese deviation (wt%) versus heat number for lowest cost option for dataset D1. Manganese window (only upper ceiling) is also shown.

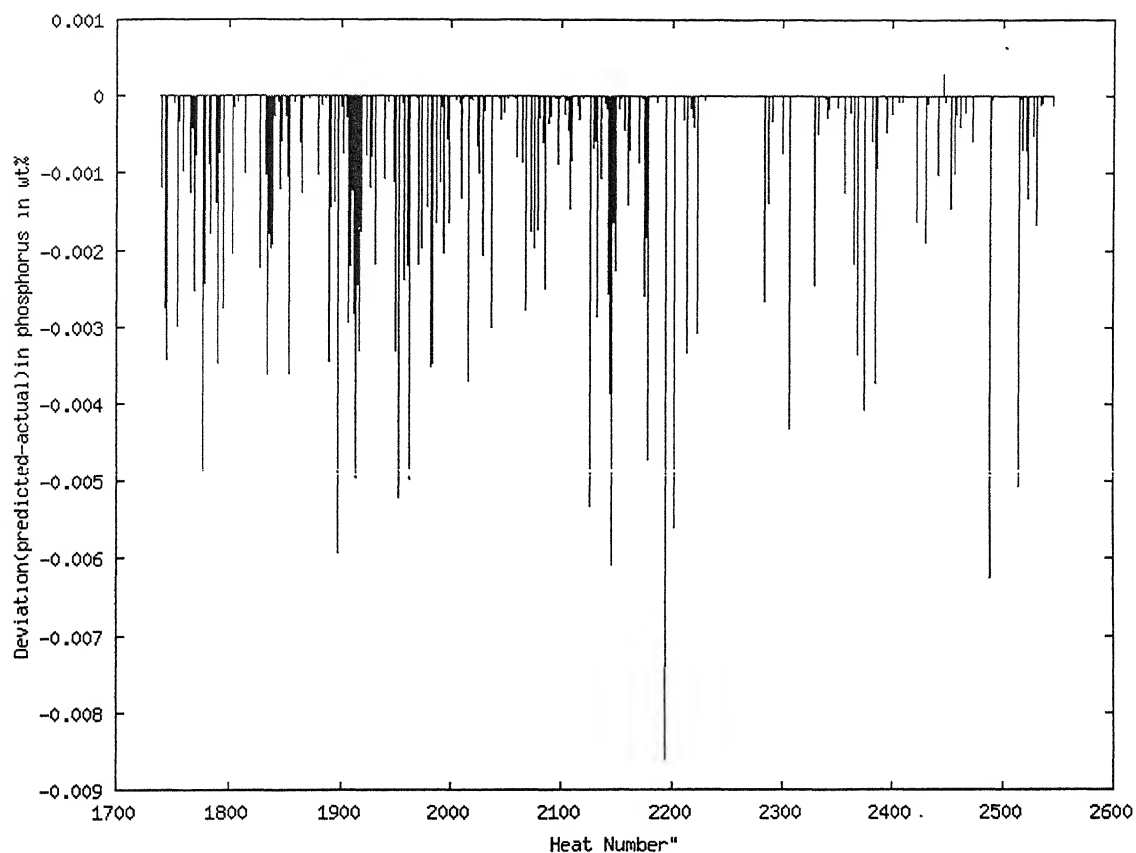


Fig 5.4 Phosphorus deviation (wt%) versus heat number for lowest cost option for dataset D1. Phosphorus window (only upper ceiling) is also shown.

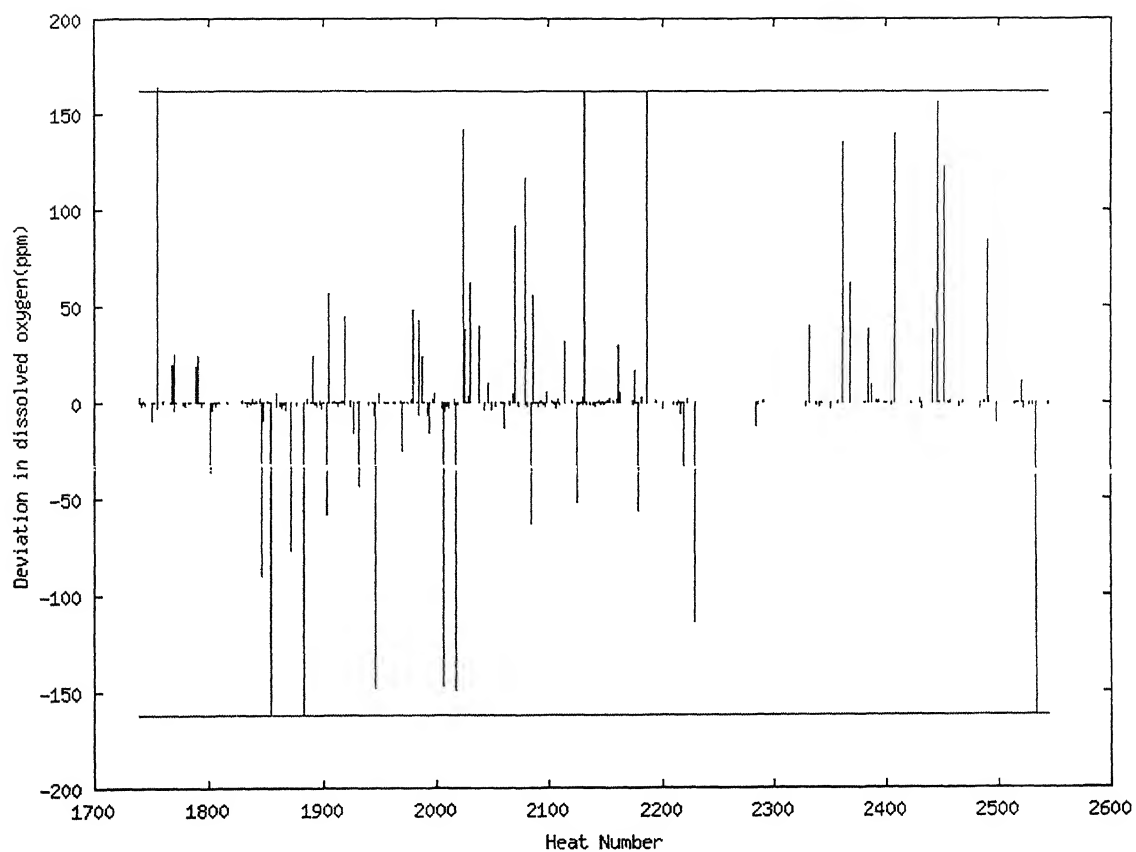


Fig 5.5 Deviation in Dissolved oxygen deviation (ppm) versus heat number for lowest cost option for dataset D1. Oxygen window is also shown.

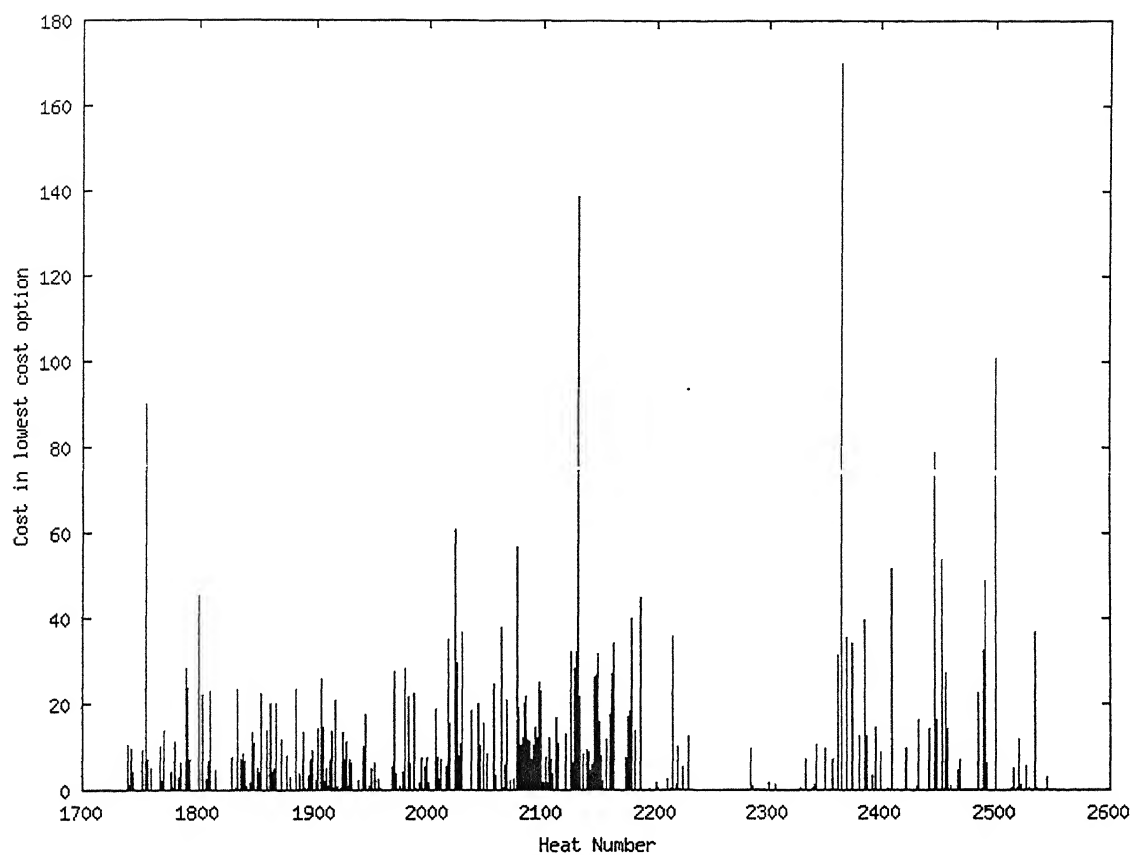


Fig 5.6 Cost for lowest cost options versus heat number for dataset D1

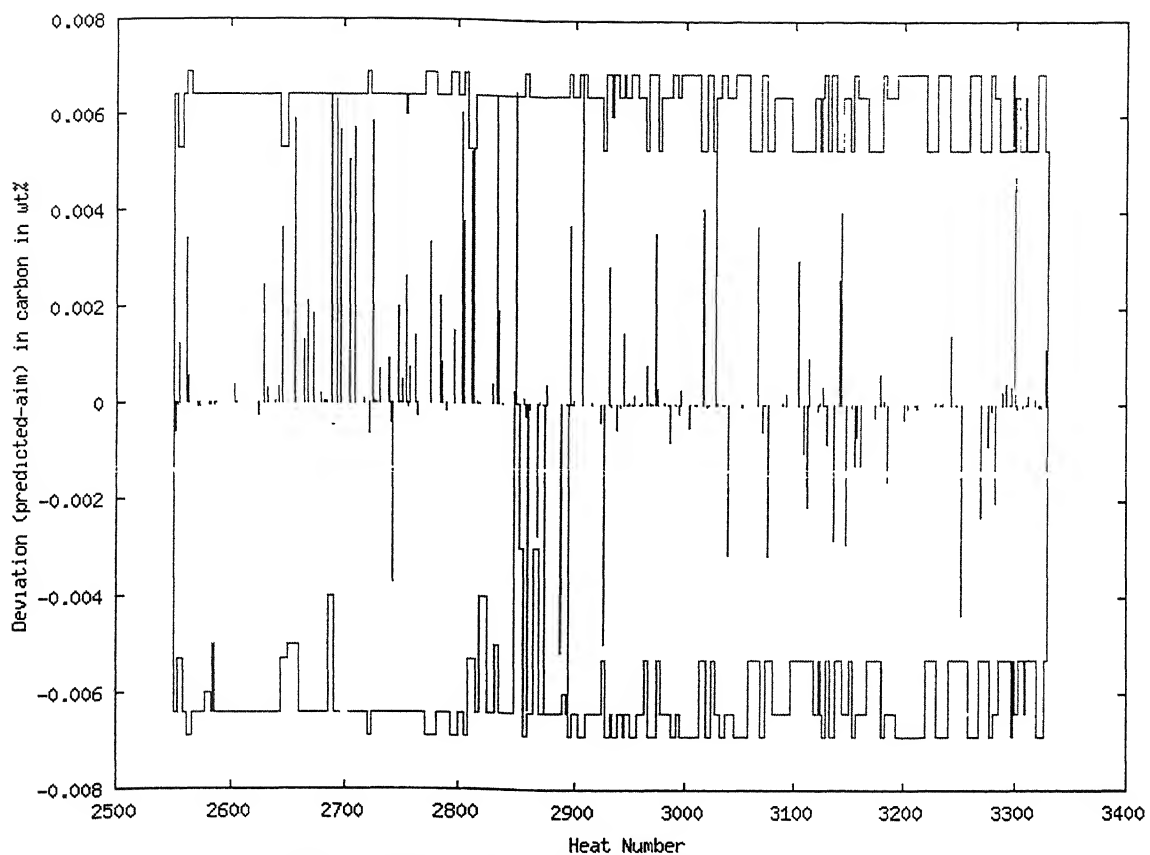


Fig 5.7 Carbon deviation (wt%) versus heat number for lowest cost option for dataset D2. Carbon window is also shown

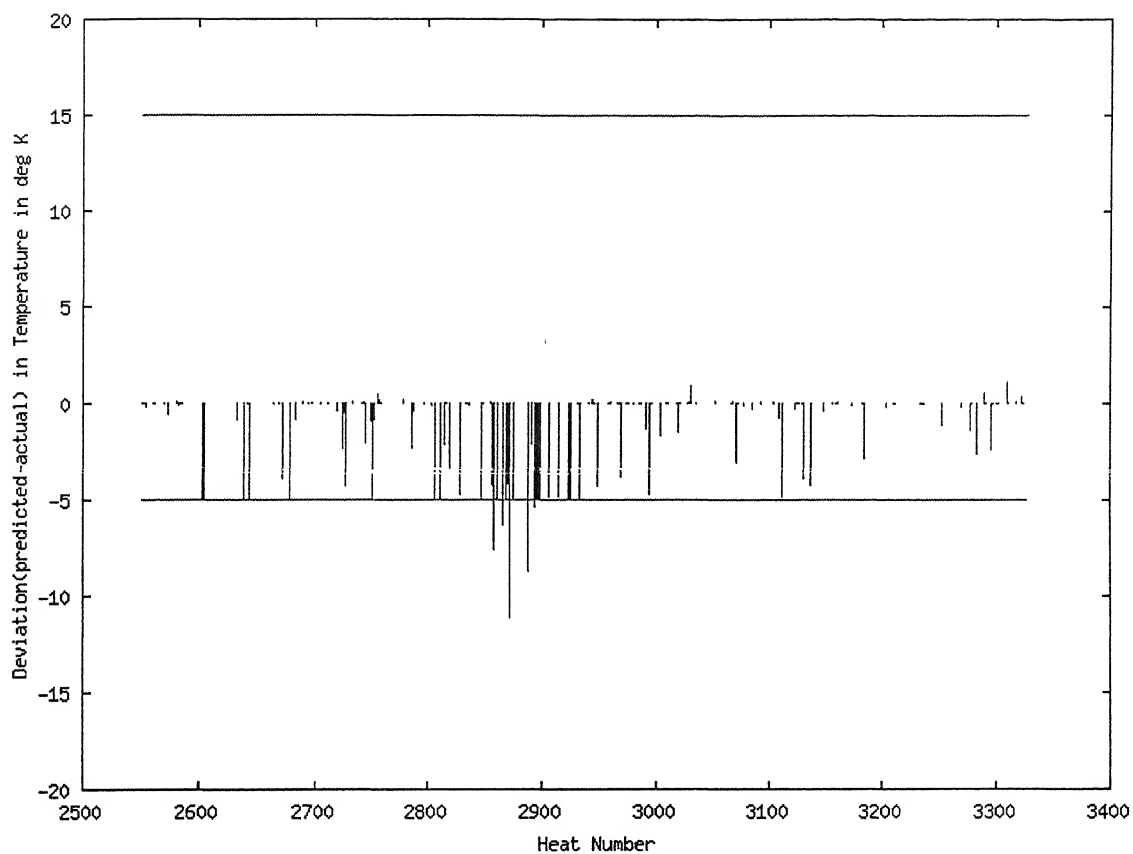


Fig 5.8 Temperature deviation (degree) versus heat number for lowest cost option for dataset D2. Temperature window is also shown

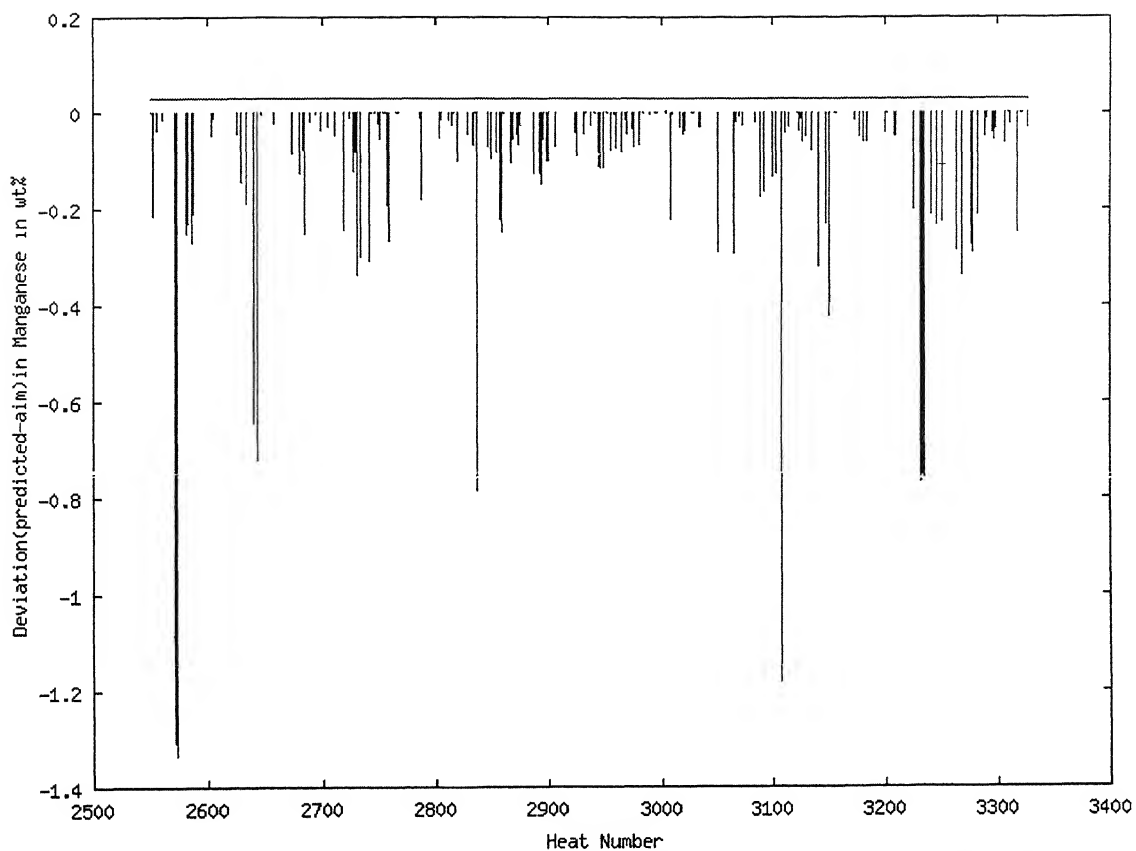


Fig 5.9 Manganese deviation (wt%) versus heat number for lowest cost option for dataset D2. Manganese window (only upper ceiling) is also shown

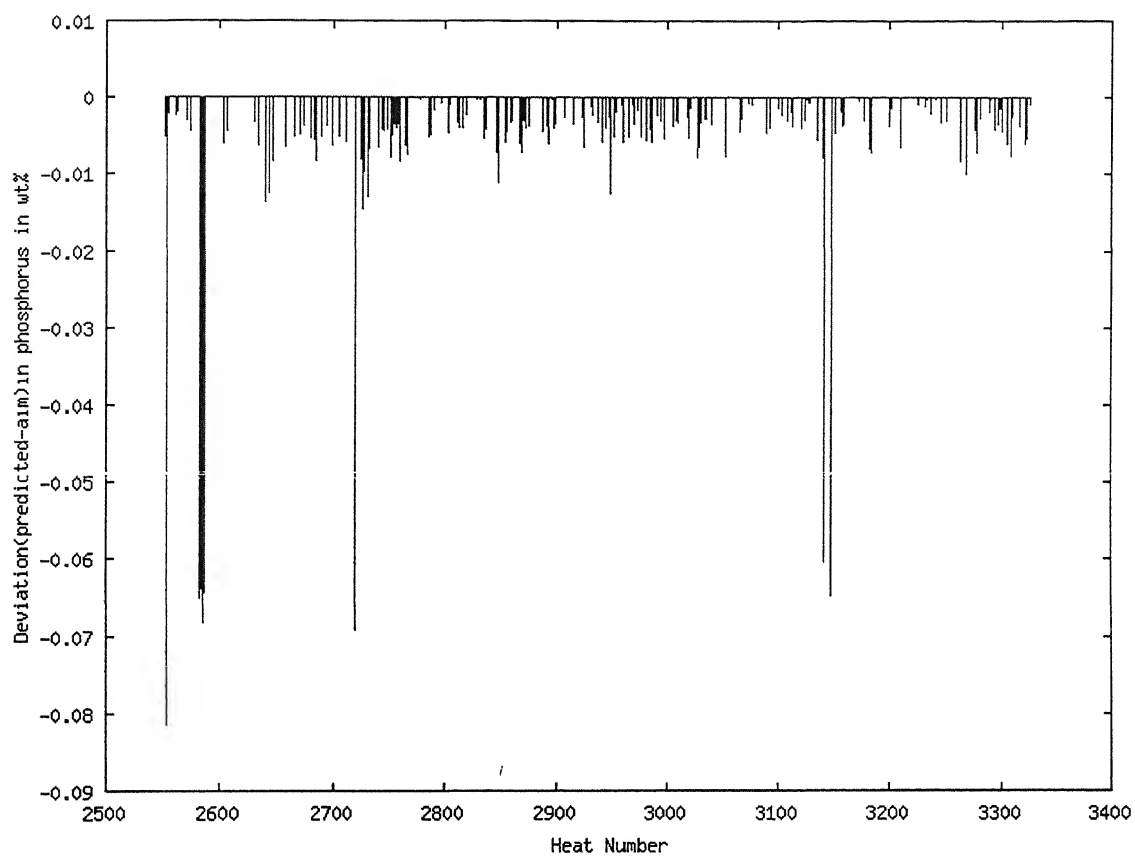


Fig 5.10 Phosphorus deviation (wt%) versus heat number for lowest cost option for dataset D2. Phosphorus window (only upper ceiling) is also shown



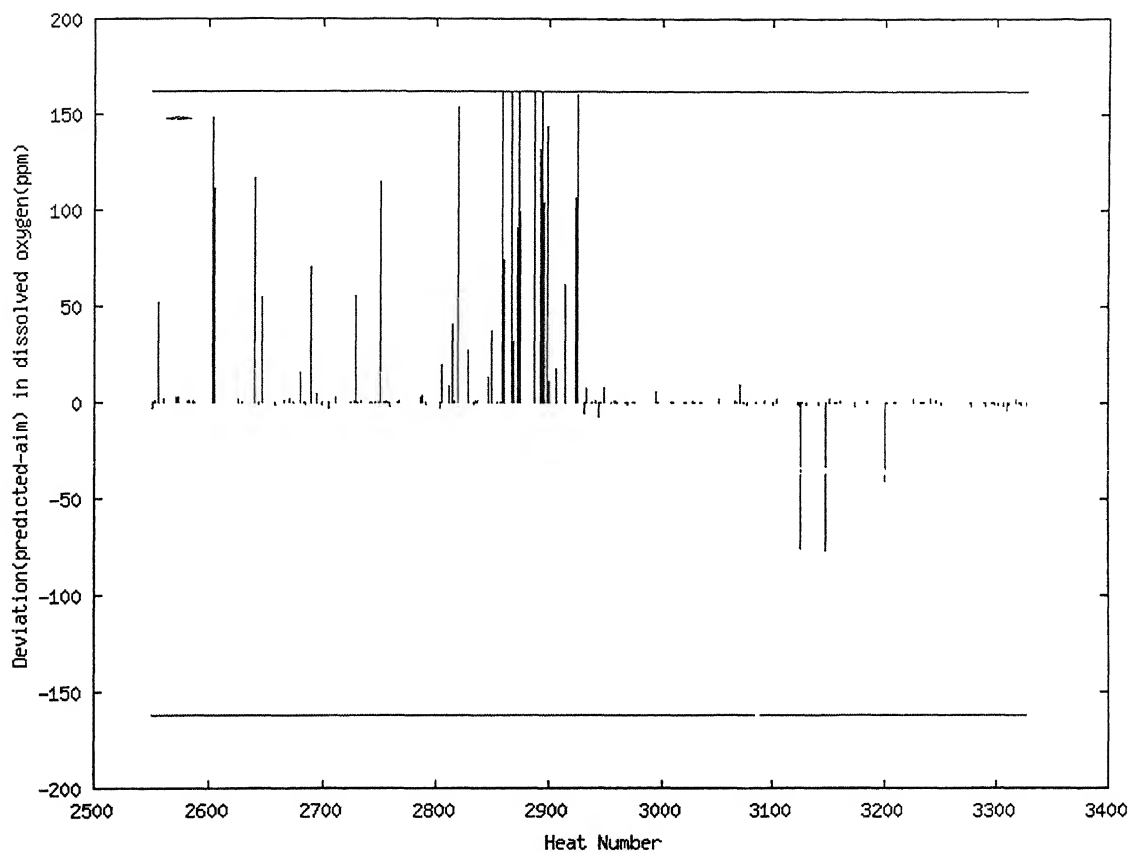


Fig 5.11 Deviation in Dissolved oxygen deviation (ppm) versus heat number for lowest cost option for dataset D2. Oxygen window is also shown

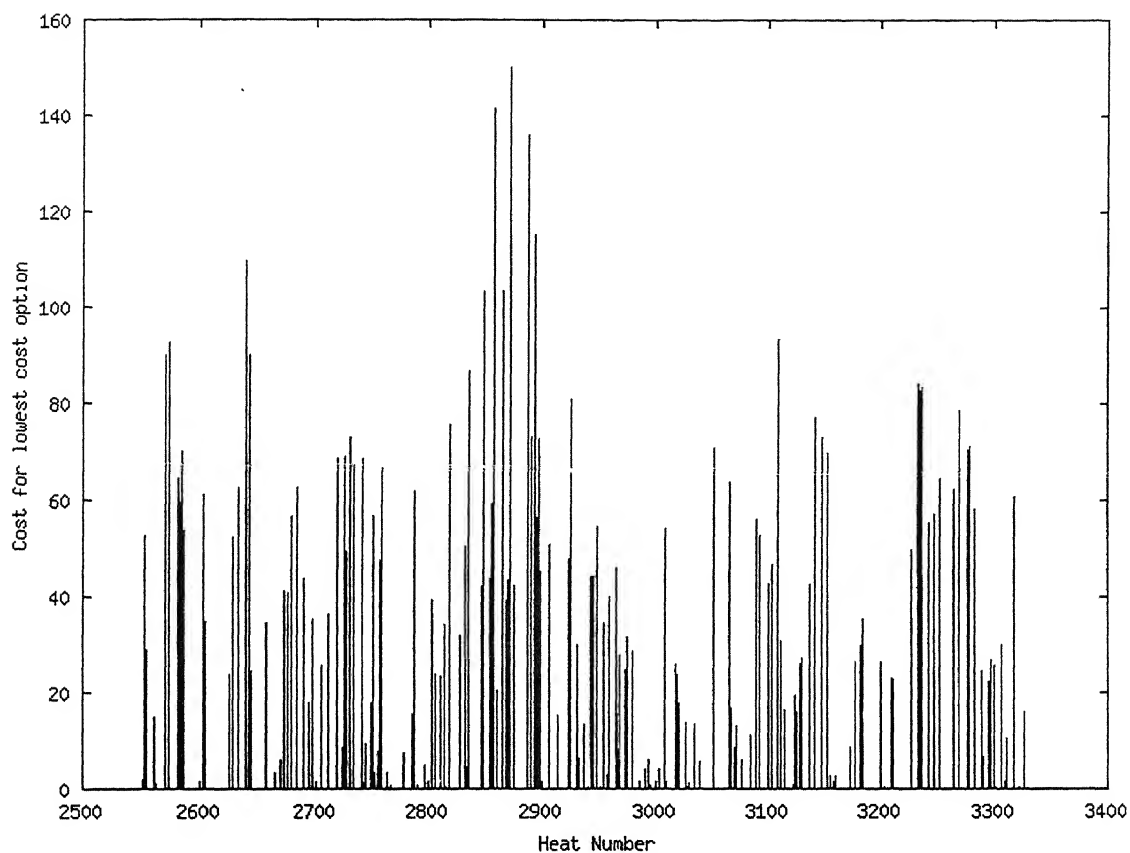


Fig 5.12 Cost for lowest cost options versus heat number for dataset D2

## Chapter 6

### Conclusions and Suggestion for Further work

#### *6.1 Conclusions*

1. Linear prediction models are developed using dataset D1. These prediction models do fairly well on dataset D1 but when we applied them to datasets D2, D3 and D4, the errors in end point prediction increases with increasing campaign life. Thus it is concluded that single set of linear prediction equation cannot give good results over a long range of time.
2. Sequential linear prediction models are developed using datasets D1-D4. In sequential linear prediction models the data file used for regression is updated every 60 heats. With sequential linear prediction models, the errors in end point prediction decreases. The coefficients of linear prediction models were plotted with campaign life. Regular patterns are found in some of the plots, while some of the plots have sudden variation of coefficients.
3. Sequential linear prediction models are developed for direct blow heats. Direct blow linear prediction models have errors higher than errors in subblance linear prediction models, but directblow models can be useful for some grades of steel where composition and temperature control is not that crucial.
4. Window around end point compositions are defined. Our aim is to prepare heats falling within window. An objective function is formulated based on this window formulation.
5. Micro genetic algorithm is applied to datasets D1 and D2 for deciding optimum process variables. In more than 97% of heats, we can reach within a narrow range of target temperature and composition for the dataset D1 and D2.

## ***6.2 Suggestion for further work***

1. We only used linear prediction models to predict end point composition and temperature. Non linear models can also be tried.
2. In sequential linear prediction models, we observed linear and exponential trends in some of the plots. This needs to be further explored so that there is no need to run regression all the time. Ideal case would be if we are able to predict the coefficients with increasing campaign life. Time series analysis can also be tried in this regard.
3. In our optimization function, we did not consider costs of operating variables themselves (for example the cost of blowing oxygen or adding ore). These costs can be added to objective function for a more realistic picture.

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# Appendix 1

## Review of Models for End Point carbon and Temperature prediction using sublance data

### 2.1 Introduction

Sublance is used in oxygen steelmaking to take a sample and also determine instantaneously the steel composition 3-4 minutes before the end of blow. This analysis is used to determine the amount of oxygen to be blown in remaining part of the blow so as to arrive at a predefined carbon and temperature at the end. Thus, we are concerned with the modeling of trajectory of process during the last few minutes of converter operation. Metal sample is also taken at the end of blow to verify carbon, phosphorus, manganese, dissolved oxygen and temperature achieved. While the blow is in progress, adjustment of lance height can be done and judicious addition of iron ore, raw dolomite and solidified slag(return slag from converter) can be made to control the trajectory of carbon as well as temperature. Since the concentrations of carbon and oxygen are related to each other, carbon may also be predicted using the dissolved oxygen content and vice versa. Hence the models for prediction of end point carbon, temperature, phosphorus, manganese and oxygen from sublance data play an important role in determining the amount of oxygen to be blown during second blow period and thereby achieve the aim composition of steel. This chapter briefly reviews the models published in literature.

#### 2.2.1 Model by Distin, Hallet and Richardson

Distin, Hallet and Richardson [9] have assumed in their study on the decarburization of liquid Fe-C alloys with O<sub>2</sub> and CO-CO<sub>2</sub> mixtures that the concentration of carbon at the surface becomes virtually zero at the instant of oxide formation. When the oxide appears on the surface, rate of decarburization can be written as

$$R_c = \frac{k_c A}{V} (n_c^b)$$

where  $R_c$  is rate of decarburization(mol/sec),  $k_c$  is mass transfer coefficient of carbon(m/sec)  $n_c^b$  is concentration of carbon in bulk and  $A$ ,  $V$  are the area and volume of droplet respectively in SI units. Above equation can be rewritten as

$$-\frac{d[\%C]}{dt} = \frac{k_c A}{V} [\%C]^b$$

where  $[\%C]$  is carbon concentration in weight percent and superscript  $b$  denotes bulk.

For spherical droplets

$$k_c = \frac{5D}{a}$$

where  $D$  is diffusivity of carbon,  $a$  is radius of droplet.

### 2.2.2 Model by Bessho et al.

Bessho et al. [10] have developed a dynamic model, based on exponential dependence of decarburization rate on carbon content. This model has been applied to estimate carbon content and temperature of Q-BOP heats after the sublance measurement. End point carbon content at any arbitrary time after the measurement by the sensor lance can be calculated, by the equation

$$C_{fa} = (C_0 - C_p) \ln \left[ \frac{R}{1 - \exp \frac{C_0 - C_{SL}}{C_p - C_0} + R \exp \frac{C_0}{C_p - C_0}} \right]$$

where  $R = \exp \frac{\xi \Delta O_2 - C_{SL}}{C_p - C_0}$ . Here  $\Delta O_2$  is the amount of oxygen blown after the measurement by sensor lance.  $C_{SL}$  is carbon content determined by sensor lance,  $C_0$  is



critical carbon content below which decarburization does not substantially occur and is found to be 0.01% for Q-BOP.  $\xi$  is the theoretical maximum decarburization rate,.  $C_p$  is a parameter derived statistically based on operational variables. Bessho et al. used a semi empirical equation to estimate the temperature rise.

$$T_f = T_{SL} + P.\Delta O_2 + Q.\left[\frac{1}{C_f} - \frac{1}{C_{SL}}\right] + R$$

where  $T_f$ ,  $C_f$  are the temperature and carbon content of the bath at blowing end respectively.  $T_{SL}$ ,  $C_{SL}$  are the temperature and carbon content of the bath measured by sublance.  $\Delta O_2$  is amount of blowing after sublance measurement and P,Q,R are parameters which are calculated from multiple regression analysis by using actual operational data.

### 2.2.3 Model by Byun et al.

Byun et al. [11] employed a simplified form of exponential model and they also incorporated the effect of other operational variables on oxygen consumption by multiple linear regression. The final equation for amount of oxygen to blown to achieve the target carbon content at the end point is given by

$$\Delta O_{2,cal} = \frac{W_{st}}{\alpha\beta} \left[ \beta(C_e - C_s) - \ln \left[ \frac{1 - \exp - \beta(C_e - C_s)}{1 - \exp - \beta(C_s - C_e)} \right] + \sum_i \gamma_i (X_i - \bar{X}_i) + \gamma_0 \right]$$

where  $C_e$  is target end point carbon content,  $C_s$  is sublance carbon content,  $\alpha$  is maximum theoretical decarburization rate,  $\beta = \frac{1}{C_p - C_0}$  where  $C_p$  and  $C_0$  are same as defined in section 2.2.2.  $W_{st}$  is weight of molten steel (kg).  $\gamma_i$  = regression coefficient,  $\gamma_0$  = regression constant,  $X_i$  = operational variables,  $\bar{X}_i$  = standard operational variables. Temperature rise can be calculated by the equation

$$\Delta T = \varepsilon_1 (C_s - C_e) + \varepsilon_2 \frac{1}{C_e - C_s} + \varepsilon_3 \Delta O_2 + \sum_i \gamma_i (X_i - \bar{X}_i) + \gamma_0$$

where  $\varepsilon_i$  is regression coefficient.

## Appendix 2

### ReadMe file of GA Program

Below is the text which is contained in ReadMe file of GA program. This is helpful in understanding and running the program.

D.L. Carroll's FORTRAN Genetic Algorithm Driver

---

This is version 1.7, last updated on 12/11/98.

Download from: <<http://www.staff.uiuc.edu/~carroll/ga.html>>

Copyright David L. Carroll; this code may not be reproduced for sale or for use in part of another code for sale without the express written permission of David L. Carroll.

This genetic algorithm (GA) driver is free for public use. My only request is that the user reference and/or acknowledge the use of this driver in any papers/reports/articles which have results obtained from the use of this driver. I would also appreciate a copy of such papers/articles/reports, or at least an e-mail message with the reference so I can get a copy. Thanks.

This program is a FORTRAN version of a genetic algorithm driver. This code initializes a random sample of individuals with different parameters to be optimized using the genetic algorithm approach, i.e. evolution via survival of the fittest. The selection scheme used is tournament selection with a shuffling technique for choosing random pairs for mating. The routine includes binary coding for the individuals, jump mutation, creep mutation, and the option for

single-point or uniform crossover. Niching (sharing) and an option for the number of children per pair of parents has been added. More recently, an option for the use of a micro-GA has been added.

For companies wishing to link this GA driver with an existing code, I am available for some consulting work. Regardless, I suggest altering this code as little as possible to make future updates easier to incorporate.

Any users new to the GA world are encouraged to read David Goldberg's "Genetic Algorithms in Search, Optimization and Machine Learning," Addison-Wesley, 1989.

The seven FORTRAN GA files are: ga170.f

- ga.inp
- ga2.inp (w/ different namelist identifier)
- ga.out
- ga.restart
- params.f
- ReadMe (this file!)

I have provided a sample subroutine "func", but ultimately the user must supply this subroutine "func" which should be your cost function. You should be able to run the code with the sample subroutine "func" and the provided ga.inp file and obtain the optimal function value of 1.0000 at generation 187 with the uniform crossover micro-GA enabled (this is 935 function evaluations). Note that because different computers may treat precision and truncation differently, I have seen cases where two computers using the same input produce different evolution histories (but still converge to the optimal).

I still recommend using the micro-GA technique (`microga=1`) with uniform crossover (`iuniform=1`). However, if possible, I strongly suggest that you use values of `nposibl` of  $2^n$  (2, 4, 8, 16, 32, 64, etc.). While my test function works fine for other values of `nposibl`, I have encountered problems where the uniform crossover micro-GA has difficulty with parameters having long bit strings and a non- $2^n$  value of `nposibl`, e.g. `nposibl=1000`, will have 10 bits assigned (for this case I would suggest running `nposibl=1024` rather than 1000); I am presently investigating possible fixes for this situation.

---

Updates:

Version 1.7 includes several improvements:

- (i) The coding and input files are cleaned up to provide identical output across a wider range of computers.
- (ii) The arrays have been rearranged to enable a more efficient caching of system memory. For cases with very large population sizes, run time improvements of as much as a factor of 4-6 were observed! For population sizes less than 1000 you will not see much change.
- (iii) A summary of the results has been added to the end of the output file.
- (iv) An alternate input file "ga2.inp" has been included. Some compilers require an '&' and a '/' in the namelist input file, rather than '\$' signs.
- (v) For those wishing to try ever harder test functions, the included function is now N-dimensional, where N is simply determined by the number of parameters specified (`nparam`).

Version 1.6.5 of the code allowed creep mutations to be implemented

with the micro-GA technique. (This version was never officially released.)

Version 1.6.4 of the code has a minor modification to the niching routine and another minor modification which would only affect a user having a single parameter with more than  $2^{30}$  possibilities (probably noone has used this large a number).

Version 1.6.3 of the code fixes a bug in the niching routine. Niching should now work much better than in previous versions. A few other minor changes have been made (not worth mentioning). The sample function has been changed to something a bit more challenging.

Version 1.6.2 of the code has had major restructuring in the form of converting all of the operators (crossover, mutation, etc.) into subroutines. The code logic should be a little more understandable now and it lends itself to more easily modifying parts of the code. The counter kountmx (see v1.6.1 comments below) was added to the namelist input. Otherwise, code performance should be the same.

Version 1.6.1 of the code has very minor modifications. If you are already successfully using the code, then you will not need this update.

- (i) Added a little documentation about changing format statements 1050, 1075, 1275, and 1500 when you change nparam or the total number of chromosomes (see below).
- (ii) I have commented out all of the lines of code dealing with cputime. The Macintosh specific SECNDS call was causing more questions than I had anticipated. However, other than commenting the lines out, I have left them in their location for reference in case the user wants a cputime added.

- (iii) I have included a sample output file.
- (iv) Added counter (kountmx) to control how frequently the restart file is written. This saves I/O time and wear and tear on storage device. Presently set to write every fifth generation.

Version 1.6 of the code has incorporated the ability to use a micro-GA approach; this significantly reduced the number of function evaluations to find the global maximum of my test function.

Version 1.5 of the code has added some more flexibility to your available options:

- (i) You now specify the minimum and maximum values of the parameters rather than the minimum and the increment.
- (ii) You now specify the number of possibilities you want for each parameter, not the number of bits. This modification has two features: first, the program automatically calculates the number of bits per parameter; second, you are no longer forced to have a number of possibilities equal to  $2^n$ . While the code is more efficient when there  $2^n$  possibilities per parameter, it will run quite well with a lesser number; e.g. a colleague has 25 specific airfoil families he wants to investigate, greater than 16, less than 32.
- (iii) You can now specify specific parameters for niching. Earlier versions of the code forced you to niche on all parameters. Now, the input array 'nichflg' permits you to choose the parameters for niching.
- (iv) You have an input flag to prevent the printing of specific jump and creep mutation information
- (v) You now specify the maximum values of population size, number of parameters and number of chromosomes in an include file (params.f). This sets the maximum array sizes in the code. When running, the

code only uses the array size up to npopsiz and nparam (from ga.inp) and nchrome (computed internally from the nposibl input array).

---

The code is presently set for a maximum population size of 200, 30 chromosomes (binary bits) and 2 parameters. These values can be changed in params.f as appropriate for your problem. Correspondingly you will have to change a few 'write' and 'format' statements if you change nchrmax and/or nparamax. In particular, if you change nchrome and/or nparam, then you should change the 'format' statement numbers 1050, 1075, 1275, and 1500. For example, if you have a problem with 4 parameters and 16 chromosomes (bits), then you should change these format statements to be:

```
1050 format(1x,'#    Binary Code',8x,'Param1 Param2 Param3',  
+        ' Param4 Fitness')  
1075 format(i3,1x,16i1,4(1x,f6.2),1x,f6.2)  
1275 format(/" Average Values:",10x,4(1x,f6.2),1x,f6.2/  
1500 format(i5,3x,16i2)
```

The CPU time related lines of code reference a Macintosh specific time function (SECNDS). To avoid compiler errors with other computers, I have commented out these lines of code. If you wish to have cputime output, then you will have to change the time functions for the specific computer you are running on. Most modern Unix machines will recognize the 'etime' function; these lines are added to the code along with the variable 'tarray' and 'cpu...again, to avoid compiler errors with different computers, these lines of code are also commented out.

A common problem arises with the Microsoft PowerStation compiler, i.e., PowerStation does not recognize the abbreviation NML for NAMELIST. If you are using PowerStation, you will likely have to substitute NAMELIST



for all instances of NML.

Please feel free to contact me with questions, comments, or errors  
(hopefully none of latter).

Enjoy!

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#####  
#####

micro-GA Tip:

My favorite GA technique is still the micro-GA. At this point, I recommend  
using the micro-GA with uniform crossover and a small population size. The  
following inputs gave me excellent performance:

microga = 1  
npopsiz = 5  
maxgen = 100  
iuniform = 1

I have also gotten good performance with the single-point crossover (iuniform=0), micro-GA.

If you decide to use the micro-GA, you will not need to worry about the population sizing or creep mutation tips below.

See the Krishnakumar reference below for more information about micro-GA's.

#####  
#####

### Population Sizing Tip:

I've had a lot of people ask me about population sizing, especially people who are attempting large problems where 100 individuals is probably not enough. The true authority on the subject is David Goldberg, but here is a crude population scaling law in my paper (based on Goldberg & Deb, 1992):

$$\text{npopsiz} = \text{order}[(l/k)(2^{**k})] \text{ for binary coding}$$

where  $l = \text{nchrome}$  and  $k$  is the average size of the schema of interest (effectively the average number of bits per parameter, i.e. approximately equal to  $\text{nchrome}/\text{nparam}$ , rounded to the nearest integer). I find that when I have uniform crossover and niching turned on (which I recommend doing), that this scaling law is usually overkill, i.e. you can most likely get by with populations at least twice as small.

Remember to make the parameter 'indmax' (in 'params.f') greater than or equal to 'npopsiz'.

#####  
#####

### Creep Mutation Probability Tip:

I generally like to have approximately the same number of creep mutations and jump mutations per generation. Using basic probabilistic arguments, it can be shown that you will get approximately the same number of creep and jump mutations when

$$p_{\text{creep}} = (n_{\text{chrome}}/n_{\text{param}}) * p_{\text{mutate}}$$

where  $p_{\text{mutate}}$  (the jump mutation probability) is  $1/n_{\text{popsiz}}$ .

#####  
#####

Suggested reading that I have found to be of use:

Goldberg, D. E., and Richardson, J., "Genetic Algorithms with Sharing for Multimodal Function Optimization," Genetic Algorithms and their Applications: Proceedings of the Second International Conference on Genetic Algorithms, 1987, pp. 41-49.

Goldberg, D. E., "Genetic Algorithms in Search, Optimization and Machine Learning," Addison-Wesley, 1989.

Goldberg, D. E., "A Note on Boltzmann Tournament Selection for Genetic Algorithms and Population-Oriented Simulated Annealing," in: Complex Systems, Vol. 4, Complex Systems Publications, Inc., 1990, pp. 445-460.

Goldberg, D. E., "Real-coded Genetic Algorithms, Virtual Alphabets, and Blocking," in: Complex Systems, Vol. 5, Complex Systems Publications, Inc., 1991, pp. 139-167.

Goldberg, D. E., and Deb, K., "A Comparative Analysis of Selection Schemes Used in Genetic Algorithms," in: Foundations of Genetic Algorithms, ed. by Rawlins, G.J.E., Morgan Kaufmann Publishers, San Mateo, CA, pp. 69-93, 1991.

Goldberg, D. E., Deb, K., and Clark, J. H., "Genetic Algorithms, Noise, and the Sizing of Populations," in: Complex Systems, Vol. 6, Complex Systems Pub., Inc., 1992, pp. 333-362.

Krishnakumar, K., "Micro-Genetic Algorithms for Stationary and Non-Stationary Function Optimization," SPIE: Intelligent Control and Adaptive Systems, Vol. 1196, Philadelphia, PA, 1989.

Syswerda, G., "Uniform Crossover in Genetic Algorithms," in: Proceedings of the Third International Conference on Genetic Algorithms, Schaffer, J. (Ed.), Morgan Kaufmann Publishers, Los Altos, CA, pp. 2-9, 1989.

#####  
#####

If you are interested in my work (which may give some insights into how and why I coded some aspects of my GA), I can mail copies of three papers of mine.

G. Yang, L.E. Reinstein, S. Pai, Z. Xu, and D.L. Carroll, "A new genetic algorithm technique in optimization of permanent 125-I prostate implants,"

Carroll, D. L., "Chemical Laser Modeling with Genetic Algorithms,"  
AIAA J., Vol. 34, 2, 1996, pp.338-346.

(A preprint version of this paper can now be downloaded in PDF format  
via my website:

<<http://www.staff.uiuc.edu/~carroll/gatips.html>> look for AIAA1996.pdf)

Carroll, D. L., "Genetic Algorithms and Optimizing Chemical Oxygen-Iodine  
Lasers," Developments in Theoretical and Applied Mechanics, Vol. XVIII,  
eds. H.B. Wilson, R.C. Batra, C.W. Bert, A.M.J. Davis, R.A. Schapery, D.S.  
Stewart, and F.F. Swinson, School of Engineering, The University of Alabama,  
1996, pp.411-424.

(This paper can now be downloaded in PDF format via my website:

<<http://www.staff.uiuc.edu/~carroll/gatips.html>> look for SECTAM18.pdf)

#####  
#####

Disclaimer: this program is not guaranteed to be free of error  
(although it is believed to be free of error), therefore it should  
not be relied on for solving problems where an error could result in  
injury or loss. If this code is used for such solutions, it is  
entirely at the user's risk and the author disclaims all liability.

## Appendix 3

### Script of a session with the package

Script started on Sun Feb 18 00:19:40 2001

\$ ⇒ inst

/tmp/ccxTYckW.o: In function `main':

/tmp/ccxTYckW.o(.text+0xa): the `gets' function is dangerous and should not be used.

/tmp/ccTojbTU.o: In function `main':

/tmp/ccTojbTU.o(.text+0xa): the `gets' function is dangerous and should not be used.

/tmp/cc7jo8an.o: In function `main':

/tmp/cc7jo8an.o(.text+0xa): the `gets' function is dangerous and should not be used.

\$ ⇒ work

Give the hotmetal weight(Kgs) : 271900

Give the scrap weight(Kgs) : 52100

Give the hot metal manganese(wt%) : 0.352

Give the hot metal phosphorus(wt%) : 0.059

Give the hot metal silicon(wt%) : 0.556

Give the lime added during first blow(Kgs) : 11231

Give the dolomite added during first blow(Kgs) : 0

Give the return slag added in first blow(Kgs) : 3346

Give the temperature at sublimance point (degree C) : 1561

Give the carbon at sublimance point(wt%) : 0.441

Give aim temperature(degree C) : 1625

Give aim carbon(wt%) : 0.043

Give aim manganese(wt%) : 0.105

Give aim phosphorus(wt%) : 0.007

Give aim dissolved oxygen(ppm) : 618

#####The FIRST OPTION#####

---

Suggested Operating Parameters

---

O22 lime2 dolo2 ore2 rslg2 rdl2 hlans2

2271.0 375.0 0.0 0.0 0.0 0.0 250.0

---

### Composition Report

#####

predicted    target

#####

Carbon	0.047	0.043
Dissolved Oxygen	768	618
Temperature	1645	1625
Manganese	0.1357	0.1050
Phosphorus	0.0078	0.0070

#####

The heat lies outside the window

cost is 243

#####The SECOND OPTION#####

---

### Suggested Operating Parameters

---

O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2351.0	0.0	2000.0	0.0	0.0	1498.0	232.0

---

### Composition Report

#####

predicted    target

#####

Carbon	0.047	0.043
Dissolved Oxygen	646	618
Temperature	1625	1625
Manganese	0.1034	0.1050
Phosphorus	0.0055	0.0070

#####

The heat lies inside the window

cost is 16

#####The THIRD OPTION#####

---

Suggested Operating Parameters						
O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2231.0	270.0	0.0	943.0	1694.0	0.0	215.0

---

Composition Report		
#####		
	predicted	target
#####		
Carbon	0.044	0.043
Dissolved Oxygen	623	618
Temperature	1625	1625
Manganese	0.0981	0.1050
Phosphorus	0.0070	0.0070
#####		

The heat lies inside the window  
cost is 11

#####THE BEST OPTION#####

---

Suggested Operating Parameters						
O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2231.0	270.0	0.0	943.0	1694.0	0.0	215.0

---



## Composition Report

#####

	predicted	target
--	-----------	--------

#####

Carbon	0.044	0.043
--------	-------	-------

Dissolved Oxygen	623	618
------------------	-----	-----

Temperature	1625	1625
-------------	------	------

Mangnese	0.0981	0.1050
----------	--------	--------

Phosphorus	0.0070	0.0070
------------	--------	--------

#####

The heat lies inside the window

cost is 11

\$ exit

Script done on Sun Feb 18 00:24:40 2001

# Composition Report

#####

	predicted	target
--	-----------	--------

#####

Carbon	0.044	0.043
Dissolved Oxygen	623	618
Temperature	1625	1625
Mangnese	0.0981	0.1050
Phosphorus	0.0070	0.0070

#####

The heat lies inside the window

cost is 11

\$ exit

Script done on Sun Feb 18 00:24:40 2001

## Appendix 4

### Data files

#### A4.1 Data set D1

Heatno	Chargno	date	Wbath	Gry	Gschrot	C_ry	Mn_ry	P_ry	Si_ry	Lnslf	
Lime1	dolm1	Ore1	Rslg1	Rdl1	T1	C1	Mn1	P1	O21	O22	lime2
dolm2	Ore2	Rslg2	Rdl2	Hlns2	T2	C2	Mn2	P2	Oact2		
1739	20844	01 09 00	298800	271900	52000	4.587	0.352	0.059	0.556	225	
11231	0	5422 3346	0	1561	0.441	0.264	0.027	11194	2240	0	
0	0	0 1516	217	1625	0.043	0.105	0.007	618			
1740	11945	01 09 00	316500	292700	48600	4.635	0.374	0.059	0.524	135	
14918	0	6122 3711	485	1575	0.479	0.261	0.021	13066	2339	0	
0	0	0 463	214	1659	0.046	0.132	0.009	877			
1741	11946	01 09 00	334000	292300	60200	4.891	0.402	0.058	0.858	136	
17951	0	11947 3855	3995	1600	0.283	0.255	0.014	13486	1781	0	
0	0	0 729	221	1662	0.046	0.124	0.006	644			
1743	11947	01 09 00	318600	274800	64900	4.910	0.399	0.058	0.833	137	
14370	0	7923 3574	3993	1594	0.351	0.235	0.032	13072	1861	0	
0	0	0 512	212	1656	0.056	0.140	0.011	631			
1744	20846	01 09 00	332800	292100	59600	4.741	0.384	0.059	0.622	7	
14500	0	7173 3430	1993	1627	0.225	0.308	0.026	13218	1475	0	
0	0	0 1101	236	1654	0.060	0.209	0.013	352			
1745	11948	01 09 00	318700	284600	56600	4.673	0.376	0.060	0.581	138	
13884	0	6053 2644	0	1599	0.284	0.255	0.037	13034	1703	0	
0	0	0 343	212	1666	0.045	0.141	0.014	865			
1751	11952	01 09 00	323600	296900	44500	4.651	0.372	0.056	0.507	142	
15089	0	7793 3664	577	1611	0.239	0.275	0.020	13359	1802	0	
0	0	0 0	213	1685	0.040	0.149	0.010	886			
1752	20849	01 09 00	335900	305500	47800	4.657	0.381	0.060	0.623	10	
17708	0	6181 3931	956	1620	0.348	0.345	0.024	13631	1995	0	
0	460	0 0	238	1690	0.050	0.184	0.011	579			
1755	20852	01 09 00	325900	295800	59500	4.631	0.381	0.059	0.545	13	
17506	0	1778 3918	0	1629	0.243	0.287	0.018	13836	1789	0	
0	0	0 0	238	1703	0.042	0.152	0.009	524			
1756	20853	01 09 00	321000	306800	35600	4.626	0.395	0.060	0.512	14	
18096	0	6802 4032	1494	1627	0.256	0.277	0.020	13618	1564	0	
0	0	0 0	235	1696	0.044	0.154	0.009	700			
1760	11953	01 09 00	331300	305600	49000	4.756	0.398	0.060	0.559	143	
16091	0	7103 3960	318	1598	0.347	0.287	0.030	13778	2186	0	
1	0	0 0	225	1683	0.046	0.154	0.012	769			
1763	11955	01 09 00	325400	291700	64000	4.603	0.406	0.062	0.894	145	
18655	0	6951 5062	0	1588	0.362	0.261	0.009	13377	2008	0	
0	0	0 92	210	1657	0.065	0.145	0.006	602			
1766	20859	01 09 00	318500	290100	52000	4.705	0.344	0.054	0.418	20	
11992	0	4396 2958	0	1599	0.540	0.330	0.037	11849	2099	0	
0	0	0 1198	234	1650	0.084	0.212	0.016	266			
1767	11957	01 09 00	319000	294000	50900	4.536	0.382	0.057	0.597	147	
14302	0	4001 3543	0	1625	0.286	0.299	0.025	13563	1505	0	
0	0	0 176	224	1671	0.052	0.193	0.015	720			
1768	20860	02 09 00	314700	310700	41200	4.420	0.361	0.057	0.372	21	
13181	0	1511 3085	607	1600	0.486	0.301	0.029	12470	2068	0	
0	0	0 534	231	1670	0.053	0.193	0.013	451			

1769	11958	02	09	00	328400	298700	59300	4.689	0.372	0.057	0.405	148
12143	0	2612	2961	0	1601	0.387	0.315	0.031	13593	2001	0	
2002	0	0	0	214	1677	0.048	0.179	0.016	744			
1770	20861	02	09	00	322400	305100	48000	4.625	0.369	0.057	0.487	22
16085	0	4396	3503	737	1596	0.427	0.303	0.029	12949	2117	0	
0	0	0	1	233	1669	0.054	0.186	0.012	454			
1771	11959	02	09	00	329800	296100	63700	4.741	0.384	0.057	0.643	149
16882	0	4114	4148	0	1616	0.208	0.287	0.025	14175	1510	0	
0	0	0	0	220	1666	0.053	0.163	0.011	712			
1777	11962	02	09	00	314600	283400	60200	4.689	0.378	0.056	0.569	152
13724	0	4392	3348	0	1597	0.427	0.264	0.031	13096	1929	0	
2003	0	0	499	206	1656	0.059	0.160	0.013	513			
1778	20865	02	09	00	308000	289000	52900	4.638	0.368	0.058	0.586	26
13516	0	4097	5481	485	1599	0.539	0.217	0.044	12386	2079	0	
0	0	0	1027	229	1688	0.042	0.156	0.017	959			
1780	20866	02	09	00	331500	297800	53900	4.734	0.397	0.060	0.653	27
16065	0	8602	4995	0	1601	0.370	0.300	0.031	12995	1840	0	
0	0	0	475	240	1658	0.049	0.178	0.012	500			
1783	11965	02	09	00	321700	280300	66900	4.779	0.387	0.059	0.565	155
13435	0	6427	3789	0	1579	0.343	0.281	0.018	12817	1950	0	
1924	0	0	500	210	1639	0.051	0.141	0.008	803			
1784	20868	02	09	00	320900	288800	53300	4.990	0.396	0.059	0.527	29
13591	0	8863	4571	359	1588	0.310	0.303	0.027	12363	1749	0	
0	0	0	0	234	1648	0.049	0.172	0.011	585			
1789	20872	02	09	00	331600	310100	49100	4.625	0.375	0.057	0.490	33
16564	0	2849	5071	1492	1615	0.217	0.252	0.014	13962	1689	0	
0	0	0	0	240	1673	0.043	0.153	0.008	561			
1790	20874	02	09	00	305000	296200	43900	4.593	0.387	0.059	0.534	35
16516	0	2493	3633	1085	1616	0.395	0.328	0.033	12512	1822	0	
0	406	0	0	226	1674	0.066	0.204	0.014	447			
1791	20873	02	09	00	331500	298100	62100	4.804	0.374	0.056	0.508	34
16199	0	2513	3559	1281	1622	0.295	0.276	0.020	13683	1718	0	
0	218	0	49	239	1677	0.059	0.168	0.010	398			
1792	20875	02	09	00	316800	303100	39100	4.647	0.388	0.057	0.525	36
15576	0	7464	3427	769	1605	0.440	0.309	0.026	12715	2018	0	
0	0	0	0	233	1688	0.053	0.170	0.012	696			
1793	20876	02	09	00	327700	295100	59800	4.625	0.381	0.056	0.476	37
13538	0	2011	3078	624	1608	0.380	0.283	0.030	13229	1756	0	
0	0	0	0	244	1671	0.056	0.185	0.013	601			
1794	20877	02	09	00	318700	301600	41600	4.546	0.367	0.057	0.418	38
12952	0	4213	3066	597	1622	0.335	0.312	0.031	12770	1638	0	
0	0	0	810	239	1666	0.062	0.200	0.015	498			
1795	11967	02	09	00	323900	292900	53700	4.529	0.352	0.057	0.324	157
10497	0	2117	5378	523	1600	0.423	0.310	0.029	13629	2287	0	
1989	0	0	0	228	1683	0.041	0.153	0.017	962			
1796	20878	02	09	00	294000	273700	40500	4.599	0.366	0.057	0.388	39
11202	0	6211	3828	417	1576	0.469	0.303	0.025	11008	2039	0	
0	0	0	913	227	1639	0.064	0.174	0.012	568			
1801	11973	03	09	00	327400	293100	58800	4.542	0.379	0.058	0.456	163
13616	0	0	3457	1132	1609	0.227	0.290	0.018	13774	2235	494	
0	0	0	0	224	1688	0.048	0.144	0.010	1058			
1803	11971	03	09	00	338200	294500	65500	4.558	0.364	0.056	0.367	161
11939	0	0	3039	842	1590	0.369	0.256	0.026	13738	2610	502	
1267	0	0	0	220	1679	0.034	0.118	0.011	1165			
1804	11972	03	09	00	335100	309000	46200	4.593	0.381	0.059	0.464	162
15004	0	3812	3776	1352	1626	0.148	0.227	0.011	14176	1750	498	
0	0	0	0	229	1684	0.044	0.143	0.009	983			

1806	11974	03	09	00	316600	308900	36700	4.587	0.375	0.058	0.488	164
16354	0	5008	4122	1504	1606	0.322	0.252	0.021	13266	2296	503	
0	0	0	0	207	1687	0.045	0.130	0.009	875			
1808	20883	03	09	00	325100	292500	56400	4.455	0.375	0.058	0.484	44
16643	0	0	3669	1338	1588	0.524	0.303	0.027	12978	2455	0	
0	495	0	0	248	1664	0.053	0.177	0.010	721			
1809	11975	03	09	00	328000	296500	58000	4.670	0.385	0.056	0.487	165
11936	0	2601	3003	0	1574	0.525	0.282	0.020	13202	2553	0	
0	0	0	0	209	1668	0.052	0.139	0.011	916			
1815	11978	03	09	00	324200	297100	54900	4.654	0.372	0.058	0.469	168
18094	0	2211	4422	1502	1614	0.226	0.252	0.022	14372	2000	0	
0	0	0	0	215	1686	0.044	0.128	0.010	868			
1827	20892	03	09	00	319600	298600	54900	4.635	0.360	0.057	0.505	55
14980	0	2316	3271	1113	1590	0.585	0.269	0.032	12690	2498	0	
0	0	0	396	240	1676	0.067	0.167	0.013	792			
1828	11985	03	09	00	295700	269600	47400	4.638	0.349	0.059	0.444	175
11172	0	6609	2804	314	1587	0.312	0.291	0.026	11636	1498	0	
0	0	0	1200	187	1632	0.057	0.164	0.012	719			
1830	11986	03	09	00	337200	296400	62800	4.843	0.339	0.056	0.370	176
12545	0	4316	3105	883	1624	0.147	0.262	0.032	13951	1388	0	
0	387	0	0	208	1650	0.065	0.181	0.018	539			
1832	11987	03	09	00	334300	309400	49500	4.776	0.344	0.058	0.499	177
17221	0	6704	4225	1396	1626	0.168	0.238	0.025	14050	1484	0	
0	515	0	0	208	1670	0.047	0.141	0.012	735			
1833	20895	03	09	00	327800	295700	53200	4.705	0.338	0.057	0.416	58
13719	0	3300	2984	1002	1638	0.262	0.264	0.027	13427	1899	0	
928	0	0	1436	249	1691	0.048	0.128	0.010	796			
1834	11988	03	09	00	321500	290000	53500	4.785	0.326	0.057	0.474	178
14956	0	5195	3659	1147	1609	0.303	0.279	0.032	13139	1807	0	
0	187	0	1004	212	1680	0.054	0.151	0.013	916			
1836	20896	03	09	00	323300	297800	47300	4.775	0.320	0.058	0.405	60
14815	0	6691	5144	1235	1584	0.438	0.267	0.029	12595	2138	0	
0	915	0	33	247	1666	0.054	0.146	0.011	637			
1837	11989	04	09	00	292700	267400	50600	4.654	0.327	0.058	0.411	179
10813	0	3999	2730	354	1561	0.549	0.228	0.028	11213	2350	0	
0	951	104	0	190	1636	0.042	0.114	0.009	840			
1838	11990	04	09	00	290700	273200	42000	4.632	0.328	0.058	0.496	180
14249	0	4303	3446	991	1594	0.323	0.245	0.028	12094	2358	0	
0	0	0	0	189	1680	0.037	0.102	0.010	1224			
1839	20898	04	09	00	320600	304100	38000	4.644	0.324	0.058	0.438	62
15172	0	5852	3313	1304	1610	0.453	0.272	0.030	12738	2245	0	
0	0	0	654	239	1683	0.055	0.161	0.013	633			
1840	20899	04	09	00	322900	297900	47000	4.673	0.328	0.057	0.435	63
14314	0	3401	3270	1164	1610	0.420	0.280	0.014	12954	2079	0	
0	0	0	1002	239	1683	0.055	0.153	0.012	607			
1841	11991	04	09	00	330400	290800	66400	4.705	0.323	0.056	0.441	181
13880	0	891	3479	451	1597	0.490	0.289	0.027	13538	2133	0	
0	514	0	0	210	1659	0.058	0.169	0.011	555			
1842	20900	04	09	00	326400	304300	47100	4.762	0.336	0.061	0.475	64
15703	0	5781	3443	1387	1639	0.279	0.294	0.032	13055	1794	0	
0	0	554	1632	232	1665	0.063	0.172	0.012	623			
1843	20901	04	09	00	329300	291100	62800	4.744	0.332	0.059	0.483	65
14294	0	2202	3282	1073	1627	0.364	0.299	0.026	13103	2075	0	
0	0	0	1962	232	1667	0.063	0.177	0.012	536			
1844	11992	04	09	00	323600	290100	60500	4.632	0.314	0.061	0.366	182
15151	0	476	3664	634	1572	0.510	0.252	0.030	13895	2541	0	
0	0	0	0	214	1663	0.045	0.126	0.011	833			

1845	11993	04	09	00	317500	308200	44500	4.436	0.303	0.057	0.337	183
11742	0	1406	2924		562	1605	0.277	0.245	0.025	13347	1798	0
0	0	0	0		210	1667	0.044	0.134	0.011	817		
1846	11994	04	09	00	318500	298600	45600	4.586	0.320	0.057	0.421	184
12721	0	4486	3186		390	1597	0.362	0.263	0.020	13136	2124	0
0	0	0	0		211	1680	0.043	0.129	0.009	1011		
1847	11995	04	09	00	321500	293400	48000	4.657	0.323	0.059	0.476	185
13525	0	5415	3350		340	1570	0.356	0.223	0.016	13045	2386	0
0	0	0	0		211	1663	0.046	0.099	0.009	1040		
1848	11999	04	09	00	315400	290400	55900	4.660	0.324	0.061	0.526	189
14556	0	2482	3502		521	1599	0.297	0.246	0.022	13542	1847	0
0	0	0	0		211	1664	0.049	0.138	0.010	900		
1851	11998	04	09	00	290000	278300	39100	4.497	0.309	0.063	0.370	188
10547	0	5298	2654		345	1565	0.464	0.234	0.017	11475	2087	0
0	0	0	521		197	1639	0.047	0.129	0.010	884		
1852	12000	04	09	00	328300	297300	60100	4.574	0.318	0.060	0.380	190
11435	0	2317	2861		0	1593	0.313	0.257	0.019	13582	1785	0
0	0	0	194		217	1654	0.050	0.151	0.012	843		
1853	12001	04	09	00	324900	297300	49500	4.744	0.311	0.057	0.424	191
12951	0	8571	3252		0	1589	0.339	0.255	0.029	13062	2160	0
0	0	0	0		202	1674	0.042	0.118	0.011	1104		
1854	20902	04	09	00	309700	284700	54400	4.363	0.324	0.057	0.389	67
10256	0	1508	4733		0	1549	0.697	0.205	0.033	12419	3303	0
0	0	0	605		234	1677	0.033	0.091	0.012	1336		
1858	20904	04	09	00	314200	290200	58300	4.264	0.311	0.057	0.344	69
11255	0	0	2761		305	1564	0.586	0.258	0.032	12594	3000	0
1481	0	0	0		213	1686	0.038	0.090	0.010	1320		
1859	12004	04	09	00	319800	297800	46900	4.414	0.297	0.056	0.328	194
10320	0	0	2569		0	1612	0.374	0.293	0.026	13181	2350	0
0	0	0	0		206	1691	0.040	0.152	0.014	1098		
1862	20907	04	09	00	320400	295300	47100	4.776	0.338	0.058	0.455	72
14626	0	7921	3228		640	1575	0.373	0.255	0.022	12937	2319	0
2002	0	0	0		249	1668	0.048	0.125	0.009	982		
1863	20906	04	09	00	337100	285200	55800	4.734	0.333	0.058	0.441	71
11335	0	3611	2815		0	1610	0.193	0.257	0.020	12690	1884	0
1996	0	0	1412		237	1653	0.046	0.123	0.009	922		
1864	12006	04	09	00	321400	287400	55600	4.536	0.325	0.060	0.505	196
12495	0	1805	3084		0	1614	0.201	0.256	0.017	13420	1799	0
0	0	0	0		206	1669	0.045	0.134	0.011	923		
1865	12007	04	09	00	320000	281600	61000	4.600	0.367	0.064	0.907	197
17197	0	6699	4207		0	1613	0.127	0.218	0.013	13486	1687	0
0	0	0	0		227	1660	0.053	0.116	0.008	922		
1866	20908	04	09	00	333800	286100	73400	4.741	0.371	0.062	0.901	73
19999	0	5514	4495		0	1599	0.214	0.250	0.016	13829	2139	0
1994	0	0	0		232	1679	0.047	0.116	0.007	985		
1871	12010	05	09	00	316100	283200	63700	4.701	0.363	0.061	0.967	199
19996	0	5976	4917		0	1608	0.169	0.185	0.010	13755	1864	0
0	0	0	0		181	1661	0.043	0.102	0.005	891		
1876	20913	05	09	00	333300	300500	57700	4.849	0.325	0.057	0.522	78
16689	0	6601	3683		900	1598	0.337	0.250	0.014	13403	2098	0
0	0	0	701		233	1667	0.052	0.129	0.007	624		
1879	12014	05	09	00	313900	286000	56900	4.721	0.331	0.057	0.458	3
16333	0	1004	3620		0	1617	0.260	0.262	0.022	13626	1900	0
0	0	0	0		147	1679	0.044	0.135	0.010	1071		
1881	20915	05	09	00	327600	293000	61700	4.670	0.338	0.058	0.517	80
15613	0	497	3409		628	1614	0.396	0.285	0.027	13647	1975	0
0	0	0	1504		229	1665	0.063	0.168	0.012	499		

1882	20916	05	09	00	262900	284200	57000	4.689	0.326	0.057	0.479	81
15387	0	1588	3341	465	1614	0.359	0.277	0.025	12939	1800	0	
0	0	0	1499	224	1654	0.063	0.162	0.010	416			
1883	12016	05	09	00	317800	295200	53500	4.670	0.336	0.057	0.496	5
13981	0	3104	3444	469	1622	0.112	0.209	0.012	13440	1706	0	
0	0	0	0	149	1684	0.039	0.095	0.007	1355			
1886	20919	05	09	00	328300	294700	63100	4.597	0.328	0.058	0.584	84
17427	0	2017	3933	985	1610	0.182	0.213	0.010	13839	1575	0	
0	965	1373	0	229	1636	0.057	0.121	0.005	427			
1888	20920	05	09	00	326100	295700	44100	4.568	0.321	0.058	0.543	85
15561	0	7011	3405	539	1628	0.155	0.217	0.011	13086	1433	0	
0	966	641	0	232	1650	0.066	0.135	0.006	409			
1889	12018	05	09	00	323700	294000	54700	4.660	0.386	0.060	0.724	7
16112	0	1619	3957	931	1636	0.370	0.293	0.047	13788	1905	0	
0	0	0	1378	152	1699	0.051	0.171	0.018	989			
1890	20921	05	09	00	334900	294500	63600	4.718	0.379	0.060	0.841	86
20003	0	7398	4507	0	1608	0.257	0.274	0.020	13405	1798	0	
0	578	0	0	233	1659	0.060	0.154	0.007	459			
1891	12019	05	09	00	291400	251800	64300	4.795	0.368	0.061	0.821	8
15368	0	6489	3800	0	1586	0.332	0.233	0.035	11588	1810	0	
0	916	2095	0	143	1634	0.041	0.106	0.012	990			
1894	20924	05	09	00	325500	284800	72000	4.734	0.334	0.060	0.843	89
16655	0	5084	3715	0	1608	0.317	0.277	0.036	12869	1925	0	
0	594	284	0	229	1671	0.045	0.138	0.010	720			
1896	20926	05	09	00	315800	280300	62200	4.731	0.334	0.059	0.714	91
15971	0	6231	3491	0	1607	0.382	0.270	0.022	12445	2096	0	
2003	0	0	551	224	1662	0.051	0.150	0.008	584			
1897	12020	05	09	00	294300	260400	43600	4.615	0.312	0.059	0.892	9
15445	0	3914	2752	0	1581	0.131	0.124	0.020	12173	1670	0	
0	0	0	0	150	1638	0.044	0.063	0.007	1141			
1898	20927	05	09	00	328100	296900	53400	4.632	0.311	0.060	0.725	92
18407	0	7174	4115	334	1608	0.321	0.230	0.023	12919	2228	0	
2003	0	0	528	228	1667	0.051	0.126	0.007	607			
1900	20928	05	09	00	302400	271400	52800	4.619	0.314	0.059	0.546	93
10942	0	6318	3910	0	1551	0.612	0.230	0.021	11061	2592	0	
2001	0	0	2518	216	1610	0.046	0.092	0.006	541			
1903	12023	05	09	00	323800	297400	43400	4.759	0.349	0.061	0.675	12
19989	0	6925	4899	991	1648	0.162	0.228	0.017	14065	1725	0	
0	0	0	0	150	1706	0.044	0.118	0.009	1364			
1905	20931	05	09	00	325200	295000	62300	4.666	0.402	0.059	0.602	96
19058	0	1999	4292	1456	1570	0.497	0.227	0.008	13599	2369	0	
2001	907	0	0	228	1647	0.060	0.123	0.004	364			
1907	12025	05	09	00	320000	298000	50300	4.718	0.353	0.059	0.647	14
19997	0	2896	4915	1494	1632	0.251	0.294	0.038	14117	1955	0	
0	0	0	0	200	1708	0.042	0.144	0.014	1069			
1908	12026	05	09	00	320200	300500	46400	4.786	0.422	0.062	0.591	15
19027	0	5513	4671	1426	1635	0.269	0.320	0.030	13539	1603	0	
0	0	0	9	163	1690	0.055	0.203	0.015	678			
1909	20932	05	09	00	329400	296300	61200	4.647	0.338	0.059	0.612	97
19947	0	1586	4483	1477	1652	0.201	0.228	0.015	13821	1547	0	
0	995	815	124	229	1678	0.060	0.144	0.008	406			
1910	12027	05	09	00	323300	296000	52800	4.760	0.406	0.060	0.665	16
19316	0	4593	4757	1139	1639	0.270	0.291	0.026	13605	1601	0	
0	0	0	258	164	1687	0.060	0.188	0.013	761			
1912	12028	05	09	00	326700	299700	54600	4.600	0.344	0.061	0.641	17
18491	0	1798	4500	0	1612	0.393	0.266	0.038	13799	1806	0	
0	0	0	584	166	1673	0.058	0.171	0.015	628			

1913	20934	06	09	00	324800	294100	51300	4.798	0.382	0.059	0.518	99
18723	0	6422	4182	1495	1619	0.250	0.253	0.019	12983	1735	0	
0	0	0	999	225	1652	0.055	0.137	0.007	445			
1914	12029	06	09	00	335600	311600	51800	4.789	0.403	0.059	0.499	18
16093	0	4995	4246	1564	1633	0.328	0.320	0.037	13904	1798	0	
0	0	0	1026	174	1677	0.060	0.201	0.018	714			
1915	12030	06	09	00	322900	291200	54900	4.760	0.396	0.058	0.507	19
15315	0	4789	3717	670	1602	0.393	0.336	0.038	13065	1986	0	
0	0	0	0	184	1675	0.053	0.187	0.016	968			
1917	12031	06	09	00	336100	310200	46800	4.699	0.381	0.058	0.613	20
19491	0	6222	4880	2510	1611	0.343	0.239	0.026	14005	2239	499	
0	0	0	1135	174	1670	0.053	0.131	0.010	657			
1918	20936	06	09	00	318900	289200	54200	4.721	0.427	0.059	0.507	101
13737	0	4805	3050	346	1620	0.382	0.341	0.026	12954	1711	0	
0	0	0	0	223	1691	0.050	0.200	0.012	495			
1919	12032	06	09	00	325300	296000	49400	4.715	0.354	0.058	0.552	21
18073	0	4088	4537	994	1639	0.236	0.255	0.026	13715	1849	498	
0	0	0	1192	168	1689	0.046	0.130	0.010	1037			
1923	12034	06	09	00	332900	309300	50000	4.702	0.434	0.059	0.533	23
18602	0	5299	4684	1001	1611	0.414	0.300	0.025	13445	2476	496	
0	0	0	1248	177	1671	0.050	0.158	0.010	761			
1924	20939	06	09	00	316000	292600	44700	4.638	0.364	0.059	0.576	104
13235	0	9926	3070	0	1579	0.280	0.227	0.011	12020	1854	0	
0	0	0	558	213	1629	0.058	0.152	0.007	388			
1926	20940	06	09	00	332200	296700	60000	4.753	0.376	0.059	0.574	105
15754	0	5601	4085	0	1630	0.297	0.333	0.030	13332	1806	0	
0	849	0	0	221	1675	0.050	0.181	0.011	450			
1927	12036	06	09	00	319100	292100	51500	4.786	0.391	0.060	0.644	25
18023	0	10309	4889	3001	1557	0.418	0.220	0.012	12729	2421	0	
0	0	0	131	173	1645	0.046	0.103	0.005	755			
1929	12037	06	09	00	322300	283300	63900	4.711	0.445	0.060	0.574	26
16236	0	6946	3971	0	1570	0.340	0.302	0.020	12812	2076	0	
0	0	0	482	174	1643	0.050	0.138	0.008	773			
1931	12038	06	09	00	322700	280000	60700	4.718	0.391	0.060	0.726	27
15324	0	7041	3777	0	1603	0.313	0.289	0.035	12837	1963	0	
0	0	0	112	173	1677	0.041	0.152	0.013	1057			
1932	12039	06	09	00	331100	289800	67300	4.805	0.340	0.061	0.793	28
19261	0	7965	4651	0	1578	0.293	0.244	0.018	13543	1874	0	
0	0	0	282	178	1647	0.042	0.109	0.008	982			
1939	12044	06	09	00	327000	295400	54600	4.708	0.401	0.061	0.509	33
15071	0	7116	3679	701	1576	0.377	0.277	0.033	13114	2648	0	
0	0	0	0	200	1666	0.042	0.130	0.010	953			
1943	12045	06	09	00	323800	293800	55700	4.670	0.406	0.059	0.635	34
15134	0	5216	3426	426	1582	0.325	0.286	0.020	12974	2472	0	
0	0	0	0	220	1669	0.038	0.124	0.008	976			
1944	20948	06	09	00	319300	304800	40000	4.670	0.433	0.059	0.419	7
14577	0	6319	3270	1087	1617	0.274	0.338	0.035	12868	2056	0	
0	0	0	0	217	1696	0.037	0.159	0.013	966			
1945	12046	06	09	00	318200	294800	52400	4.558	0.386	0.059	0.470	35
13939	0	1200	3214	369	1590	0.464	0.348	0.029	12929	2826	0	
0	0	0	640	199	1689	0.034	0.144	0.013	1226			
1948	20950	06	09	00	318000	295000	41300	4.728	0.422	0.057	0.412	9
14008	0	5310	3058	1117	1619	0.291	0.337	0.038	12739	1822	0	
0	0	0	709	215	1688	0.044	0.173	0.014	778			
1949	12048	06	09	00	324300	295300	51700	4.615	0.415	0.061	0.626	37
19409	0	4015	4480	926	1610	0.268	0.316	0.031	13931	1737	0	
0	0	0	336	174	1667	0.056	0.166	0.012	802			



1953	12050	06	09	00	346700	309200	54300	4.577	0.410	0.059	0.494	39
12111	0	7307	3005	0	1575	0.360	0.269	0.033	13327	2084	0	
0	0	0	17	182	1648	0.043	0.166	0.017	816			
1955	12051	06	09	00	323500	288200	57200	4.702	0.434	0.058	0.456	40
12510	0	6785	3137	0	1583	0.303	0.312	0.025	12844	2086	0	
0	0	0	0	174	1650	0.043	0.160	0.011	817			
1957	12052	07	09	00	318300	282400	57800	4.712	0.447	0.059	0.464	41
12550	0	7095	3100	0	1589	0.274	0.334	0.034	12864	1990	0	
0	0	0	0	187	1667	0.040	0.146	0.014	1135			
1961	12054	07	09	00	335200	298300	57000	4.664	0.464	0.066	0.456	43
15478	0	3514	3689	1307	1621	0.176	0.313	0.030	14185	1763	496	
0	0	0	696	180	1671	0.041	0.154	0.014	1048			
1963	12055	07	09	00	326500	296000	48900	4.721	0.415	0.061	0.391	44
13205	0	6789	3372	1061	1585	0.357	0.284	0.034	13092	2278	491	
0	0	0	554	176	1650	0.039	0.127	0.014	1006			
1968	12058	07	09	00	336100	308000	53600	4.705	0.439	0.058	0.497	2
19062	0	4707	4668	1492	1621	0.269	0.317	0.024	14698	1753	0	
0	0	0	393	224	1685	0.046	0.175	0.012	977			
1970	12059	07	09	00	319700	294000	51100	4.676	0.432	0.060	0.415	3
15130	0	4393	3692	878	1599	0.284	0.324	0.028	13543	1961	0	
0	0	0	0	199	1680	0.052	0.162	0.012	939			
1971	20961	07	09	00	321900	302100	40700	4.616	0.407	0.059	0.437	21
12481	0	5961	3063	0	1635	0.229	0.325	0.036	12761	1715	0	
0	0	0	0	209	1691	0.052	0.193	0.016	655			
1974	12061	07	09	00	322000	306700	40900	4.686	0.420	0.060	0.578	5
20012	0	6886	5079	1450	1627	0.169	0.253	0.018	14124	1420	0	
0	0	0	0	225	1679	0.051	0.147	0.010	932			
1976	12062	07	09	00	321000	293000	48500	4.738	0.429	0.059	0.661	6
20010	0	6902	4957	1124	1623	0.248	0.291	0.022	13871	1506	0	
0	0	0	535	219	1671	0.067	0.184	0.012	887			
1977	20964	07	09	00	337800	310300	44100	4.654	0.443	0.057	0.279	24
9281	0	3405	6228	0	1635	0.328	0.399	0.037	13009	1855	0	0
0	0	722	217	1680	0.061	0.270	0.022	364				
1978	12063	07	09	00	321600	297900	52300	4.673	0.413	0.058	0.390	7
15062	0	2200	3467	1278	1622	0.435	0.346	0.037	13869	1909	0	
0	0	0	397	200	1690	0.053	0.213	0.017	921			
1979	20965	07	09	00	322500	295200	44500	4.705	0.435	0.061	0.409	25
10405	0	6109	4844	0	1620	0.423	0.368	0.036	12566	2126	0	
0	0	0	0	204	1698	0.044	0.208	0.014	501			
1982	12065	07	09	00	318100	295400	52500	4.686	0.431	0.057	0.427	9
16421	0	3010	4147	1500	1611	0.301	0.318	0.032	13881	1717	0	
0	0	0	0	197	1671	0.056	0.201	0.015	672			
1983	20967	07	09	00	317800	310000	37000	4.696	0.456	0.060	0.482	27
17842	0	6211	3992	1372	1631	0.340	0.331	0.029	13230	1724	0	
0	0	0	1	207	1697	0.057	0.202	0.013	398			
1984	12066	07	09	00	327400	296100	53300	4.795	0.410	0.057	0.544	10
19581	0	6005	4751	1343	1616	0.272	0.275	0.017	14198	1831	0	
0	293	0	0	201	1681	0.046	0.155	0.008	737			
1987	20969	07	09	00	333400	296200	61900	4.871	0.443	0.058	0.640	1
20041	0	5889	4476	843	1602	0.417	0.311	0.017	13533	2297	0	
0	0	0	0	215	1672	0.060	0.176	0.008	452			
1989	12069	07	09	00	264100	274900	42700	4.673	0.448	0.060	0.582	13
14426	0	8903	3236	2003	1516	0.787	0.250	0.011	10398	3418	0	
0	0	0	2196	168	1628	0.043	0.087	0.004	868			
1991	20971	07	09	00	324200	295400	52200	4.689	0.423	0.059	0.518	3
16971	0	2983	3889	0	1637	0.334	0.344	0.032	13236	2046	0	
0	0	0	1543	211	1695	0.047	0.177	0.011	715			

1993	12070	07	09	00	302000	269600	51700	4.625	0.402	0.056	0.389	14
10879	0	6739	2668	262	1537	0.499	0.255	0.016	11800	2502	0	
0	0	0	0	187	1635	0.044	0.117	0.008	957			
1996	20974	07	09	00	339000	309100	54300	4.686	0.408	0.055	0.383	6
15517	0	3003	3046	506	1635	0.321	0.338	0.036	13338	2030	0	
0	870	1635	0	223	1676	0.061	0.198	0.012	529			
1997	12072	07	09	00	323000	294100	55800	4.654	0.412	0.056	0.441	16
17113	0	1611	3194	0	1626	0.247	0.317	0.030	14114	1695	0	
0	0	0	0	202	1685	0.039	0.165	0.012	1077			
1998	20975	07	09	00	325600	295000	52400	4.654	0.407	0.057	0.379	7
15321	0	1511	3356	1315	1603	0.470	0.330	0.036	13413	2298	0	
0	677	0	0	217	1672	0.057	0.186	0.012	416			
2005	20979	08	09	00	324700	294200	55900	4.600	0.389	0.057	0.389	11
15466	0	2531	3393	80	1612	0.264	0.286	0.018	13363	1796	0	
0	736	0	0	217	1659	0.053	0.163	0.007	420			
2006	12076	08	09	00	328600	296000	56100	4.814	0.415	0.058	0.424	20
17826	0	6203	4354	1499	1594	0.163	0.241	0.013	14224	2348	0	
0	0	0	0	207	1689	0.035	0.095	0.007	1371			
2007	20980	08	09	00	323400	300300	44700	4.683	0.400	0.056	0.387	12
14780	0	6003	3271	1229	1621	0.179	0.262	0.016	12846	1723	0	
0	795	0	0	218	1670	0.050	0.154	0.008	588			
2008	12077	08	09	00	324100	294000	52700	4.730	0.400	0.056	0.488	21
18227	0	5191	4471	1485	1617	0.141	0.235	0.012	13942	1803	0	
0	610	0	0	205	1669	0.037	0.120	0.007	1076			
2009	20981	08	09	00	321800	296100	46000	4.734	0.403	0.059	0.548	13
19064	0	6569	4280	1492	1637	0.229	0.278	0.018	13191	1763	0	
0	912	1590	0	217	1675	0.052	0.153	0.008	503			
2011	20982	08	09	00	322100	294100	51300	4.676	0.420	0.058	0.371	14
12698	0	4141	3090	897	1604	0.432	0.344	0.030	12503	2273	0	
0	825	1010	0	219	1677	0.044	0.163	0.011	734			
2015	12080	08	09	00	330100	295100	59800	4.507	0.382	0.058	0.476	24
16304	0	0	1380	0	1602	0.464	0.321	0.051	13934	2324	0	
0	846	211	0	202	1680	0.035	0.159	0.016	1224			
2016	12081	08	09	00	325700	308200	40200	4.510	0.352	0.056	0.319	25
13716	0	3483	2183	1081	1601	0.252	0.267	0.024	13846	1855	0	
0	0	0	0	199	1661	0.046	0.151	0.011	942			
2017	20985	08	09	00	323700	293100	51800	4.616	0.408	0.063	0.484	17
15633	0	5006	3439	551	1593	0.508	0.332	0.025	12867	2703	0	
0	954	547	0	224	1682	0.040	0.138	0.008	941			
2019	20986	08	09	00	335600	299800	55100	4.699	0.403	0.058	0.528	18
16797	0	7514	3322	628	1582	0.493	0.352	0.022	12811	2553	0	
0	935	580	0	229	1662	0.046	0.156	0.007	671			
2021	20987	08	09	00	327700	295600	51700	4.786	0.390	0.056	0.334	19
13980	0	7117	3074	0	1608	0.255	0.331	0.022	12894	1714	0	
0	973	306	0	225	1653	0.065	0.173	0.009	537			
2023	20988	08	09	00	327900	292900	54500	4.689	0.402	0.061	0.542	20
15044	0	8282	3294	0	1577	0.323	0.288	0.016	12774	2361	0	
0	0	0	0	226	1662	0.044	0.146	0.007	560			
2025	20989	08	09	00	325700	295200	52900	4.775	0.401	0.056	0.331	21
12980	0	7425	4072	0	1596	0.253	0.301	0.018	12637	1962	0	
0	0	0	0	226	1660	0.050	0.169	0.009	529			
2026	20990	08	09	00	325200	293700	55400	4.667	0.410	0.059	0.483	22
15710	0	3010	4509	0	1620	0.351	0.341	0.027	13398	1811	0	
0	115	0	0	225	1674	0.051	0.189	0.011	466			
2028	20991	08	09	00	321000	304000	38100	4.763	0.407	0.057	0.388	23
16117	0	6593	3598	1179	1635	0.281	0.334	0.026	12936	1736	0	
0	0	0	0	230	1694	0.060	0.205	0.014	493			

2029	20993	08	09	00	327000	293500	52000	4.734	0.399	0.057	0.445	25
13077	0	7116	3563		313	1573	0.488	0.288	0.019	12459	2562	0
0	0	0	0		229	1664	0.055	0.156	0.008	523		
2030	12086	08	09	00	332900	289700	71900	4.638	0.391	0.057	0.438	30
15533	0	997	3289		970	1559	0.479	0.281	0.022	13662	2779	0
0	0	0	0		220	1661	0.040	0.126	0.008	1068		
2037	20998	08	09	00	334700	295100	58500	4.628	0.379	0.054	0.329	30
11019	0	2895	3641		0	1602	0.318	0.324	0.032	13067	1891	0
0	214	0	0		238	1663	0.048	0.196	0.014	519		
2039	21000	08	09	00	327300	295200	47800	4.558	0.388	0.055	0.366	32
11579	0	4516	3273		0	1623	0.353	0.320	0.029	12763	1856	0
0	0	0	1039		234	1658	0.064	0.204	0.013	379		
2043	21002	08	09	00	325500	292900	52000	4.696	0.395	0.055	0.364	34
11022	0	5585	2731		0	1595	0.224	0.289	0.015	12488	1995	0
0	0	0	0		232	1658	0.048	0.157	0.008	602		
2045	21003	08	09	00	328300	301700	56400	4.705	0.412	0.058	0.446	35
10443	0	7015	2575		0	1598	0.261	0.310	0.023	12422	2048	0
0	0	0	0		230	1674	0.037	0.145	0.011	737		
2048	21005	09	09	00	319700	294100	43900	4.482	0.404	0.057	0.356	37
12196	0	4297	2980		286	1622	0.190	0.294	0.020	12935	1702	0
0	354	0	0		221	1676	0.044	0.174	0.011	728		
2052	21007	09	09	00	326100	292200	48600	4.555	0.400	0.058	0.432	39
13179	0	4413	3075		0	1631	0.208	0.332	0.023	12995	1644	0
0	961	544	0		222	1666	0.052	0.170	0.009	524		
2057	12097	09	09	00	329000	293800	59400	4.651	0.404	0.056	0.445	41
16253	0	512	3991		1256	1634	0.138	0.280	0.019	14541	1500	0
0	0	0	690		203	1671	0.049	0.172	0.011	794		
2058	21010	09	09	00	327500	307000	43000	4.641	0.392	0.057	0.381	42
15379	0	5807	3336		406	1606	0.281	0.287	0.021	13096	1786	0
0	0	0	1359		228	1635	0.047	0.139	0.006	467		
2059	12098	09	09	00	320300	295000	54900	4.574	0.396	0.061	0.442	42
16316	0	0	3973		1372	1610	0.185	0.262	0.021	14399	2053	0
0	0	0	0		200	1675	0.045	0.135	0.010	1023		
2064	21012	09	09	00	305900	292100	35300	4.520	0.377	0.065	0.356	44
14012	0	4508	3055		1087	1594	0.512	0.295	0.027	11911	2250	0
0	0	0	1973		215	1660	0.033	0.134	0.010	802		
2065	12102	09	09	00	323000	306800	41400	4.603	0.383	0.057	0.400	46
16291	0	4191	4018		1492	1613	0.270	0.275	0.021	13815	1697	0
0	0	0	0		202	1668	0.054	0.165	0.011	647		
2067	12103	09	09	00	333000	291400	66600	4.727	0.418	0.058	0.696	47
19857	0	3106	4615		975	1626	0.160	0.284	0.029	14586	1537	0
0	0	0	0		214	1675	0.041	0.160	0.013	890		
2069	21015	09	09	00	321500	292000	55300	4.708	0.403	0.057	0.738	47
18678	0	7950	4158		551	1597	0.242	0.243	0.011	13364	2423	0
0	0	0	0		224	1698	0.038	0.099	0.005	890		
2072	12106	09	09	00	306100	270200	52500	4.744	0.421	0.057	0.556	50
13382	0	8639	3328		0	1572	0.316	0.280	0.017	11926	1900	0
0	0	0	1397		194	1625	0.051	0.134	0.007	825		
2073	12107	09	09	00	327400	291600	58700	4.750	0.415	0.059	0.587	51
18591	0	1118	4542		1499	1665	0.146	0.341	0.036	14497	1207	0
0	0	0	529		203	1691	0.071	0.262	0.023	562		
2075	21016	09	09	00	300300	254900	60200	4.708	0.417	0.058	0.622	48
11971	0	7097	2969		0	1578	0.522	0.342	0.027	10954	2558	0
0	948	0	2337		213	1641	0.045	0.112	0.008	782		
2078	21018	09	09	00	328100	288200	58900	4.779	0.433	0.057	0.500	50
15541	0	6202	3410		955	1604	0.369	0.330	0.024	13264	2371	0
0	882	0	0		230	1694	0.047	0.142	0.009	621		

2079	12110	09	09	00	318800	292900	51300	4.580	0.420	0.057	0.487	54
16431	0	1695	3034		0	1602	0.415	0.330	0.039	13210	1709	0
0	311	0	0		197	1679	0.055	0.212	0.016	788		
2081	21020	09	09	00	322500	289900	53000	4.776	0.435	0.058	0.597	52
16814	0	8235	3731		919	1613	0.278	0.306	0.019	13027	2041	0
0	763	0	0		215	1691	0.044	0.139	0.008	753		
2083	12112	09	09	00	301800	270700	52500	4.638	0.450	0.063	0.531	56
13145	0	6490	3183		0	1584	0.420	0.323	0.018	11779	1999	0
0	0	0	1631		195	1637	0.059	0.163	0.010	669		
2084	12113	09	09	00	327100	307900	41700	4.660	0.406	0.057	0.494	57
18985	0	6997	4623		0	1617	0.201	0.249	0.013	13996	1604	0
0	511	0	0		209	1672	0.060	0.147	0.008	872		
2085	21021	09	09	00	331500	290200	63000	4.772	0.443	0.060	0.838	28
20015	0	8739	4487		0	1571	0.331	0.268	0.009	13484	2328	0
0	0	0	0		222	1648	0.048	0.126	0.004	577		
2086	12114	09	09	00	297800	250000	66100	4.833	0.437	0.059	0.752	58
14856	0	8740	4118		0	1560	0.328	0.249	0.011	11649	2102	0
0	0	0	325		199	1624	0.055	0.115	0.006	818		
2088	12115	09	09	00	324500	290700	58000	4.657	0.452	0.065	0.640	59
19982	0	3422	4922		0	1619	0.312	0.339	0.030	13951	1689	0
0	0	0	0		212	1677	0.050	0.203	0.013	809		
2089	21023	09	09	00	321800	288000	56500	4.619	0.442	0.059	0.470	30
14606	0	1932	3274		957	1633	0.289	0.365	0.031	13238	1668	0
0	916	0	47		213	1685	0.053	0.200	0.010	507		
2090	21024	09	09	00	323600	300000	41500	4.529	0.432	0.057	0.465	31
14114	0	5996	3101		0	1614	0.431	0.355	0.035	12505	2070	0
0	958	0	0		212	1681	0.054	0.214	0.012	465		
2092	12117	09	09	00	320700	288200	58300	4.674	0.455	0.062	0.527	61
18042	0	2203	4423		1487	1609	0.333	0.328	0.022	13802	1748	0
0	519	0	0		209	1676	0.048	0.172	0.010	814		
2093	21025	09	09	00	328200	291300	56400	4.706	0.442	0.060	0.570	32
15727	0	5795	3452		0	1631	0.329	0.367	0.037	12791	1899	0
0	966	0	1003		218	1673	0.047	0.194	0.010	401		
2095	21026	09	09	00	326500	282100	61800	4.660	0.452	0.058	0.560	33
14478	0	4409	3274		428	1619	0.230	0.360	0.035	12882	1758	0
0	940	887	0		214	1661	0.049	0.194	0.010	504		
2096	12119	10	09	00	325500	284000	59400	4.734	0.435	0.056	0.450	63
12729	0	5303	3152		0	1608	0.361	0.348	0.027	13082	1998	0
0	0	0	0		210	1676	0.050	0.195	0.015	897		
2097	21027	10	09	00	321300	279800	60400	4.728	0.447	0.061	0.537	34
11648	0	6930	2882		0	1602	0.351	0.377	0.031	12227	2295	0
0	0	0	518		212	1682	0.038	0.180	0.010	664		
2098	12120	10	09	00	310300	269200	56600	4.667	0.456	0.058	0.506	64
12475	0	6997	3083		326	1566	0.421	0.344	0.015	11831	2089	0
0	0	0	1003		201	1633	0.056	0.181	0.008	622		
2102	12122	10	09	00	329800	284000	64700	4.705	0.461	0.056	0.551	66
13172	0	5903	3270		0	1595	0.408	0.381	0.020	13191	2260	0
0	0	0	562		209	1661	0.046	0.174	0.011	843		
2103	12123	10	09	00	301800	276100	44400	4.677	0.447	0.057	0.445	67
11828	0	7741	2886		320	1578	0.438	0.294	0.013	11698	2052	0
0	0	0	2006		196	1641	0.049	0.141	0.008	793		
2104	21030	10	09	00	327300	281100	69400	4.778	0.451	0.056	0.643	37
14989	0	4642	3308		0	1615	0.362	0.362	0.027	12490	2217	0
0	0	0	1298		215	1658	0.054	0.187	0.009	417		
2106	12124	10	09	00	322800	280900	69100	4.711	0.432	0.056	0.528	68
13778	0	3793	3417		0	1581	0.316	0.308	0.020	13262	2565	0
0	0	0	0		210	1676	0.040	0.117	0.008	1169		

2108	12125	10	09	00	329500	283100	72300	4.689	0.429	0.055	0.387	69
11886	0	1316	2939	0	1597	0.434	0.354	0.028	13423	2038	0	
0	0	0	0	209	1672	0.049	0.220	0.017	858			
2109	21033	10	09	00	319100	291100	57200	4.638	0.443	0.054	0.363	40
15000	0	899	0	3973	1618	0.329	0.297	0.035	13018	2268	0	
0	626	0	0	234	1684	0.048	0.158	0.011	674			
2113	21035	10	09	00	325200	304900	42400	4.692	0.430	0.055	0.327	42
16512	0	6081	1543	1997	1634	0.248	0.282	0.025	13145	1913	0	
0	943	2521	0	212	1669	0.043	0.144	0.008	680			
2114	12128	10	09	00	325900	283000	66300	4.759	0.433	0.054	0.347	72
11181	0	3598	2763	0	1586	0.249	0.311	0.016	13133	1900	0	
0	0	0	0	204	1658	0.042	0.153	0.009	835			
2116	12129	10	09	00	324900	289400	56600	4.744	0.462	0.055	0.344	73
11564	0	5810	2847	0	1588	0.341	0.355	0.020	13147	1886	0	
0	0	0	2	203	1660	0.045	0.182	0.012	860			
2120	12131	10	09	00	320800	282900	62500	4.737	0.451	0.054	0.354	75
11438	0	3902	2822	0	1587	0.251	0.315	0.014	13195	2438	0	
0	0	0	0	219	1685	0.037	0.132	0.009	1092			
2125	21042	10	09	00	324600	287400	52900	4.782	0.459	0.055	0.338	49
10786	0	7316	3878	410	1591	0.193	0.299	0.012	12370	1800	0	
0	0	0	0	209	1661	0.040	0.164	0.008	1227			
2126	12134	10	09	00	323100	282000	64600	4.618	0.434	0.055	0.317	78
10447	0	105	2604	0	1603	0.396	0.358	0.032	13218	1900	0	
0	0	0	14	197	1673	0.045	0.217	0.020	889			
2128	12135	10	09	00	324100	280000	70900	4.706	0.451	0.059	0.452	79
13121	0	2996	3208	0	1584	0.445	0.350	0.018	13355	2288	0	
0	0	0	0	198	1671	0.048	0.186	0.011	1048			
2129	21043	10	09	00	326200	290800	55200	4.660	0.474	0.058	0.368	50
10590	0	5006	4384	312	1594	0.343	0.370	0.018	12477	2141	0	
0	0	0	865	209	1656	0.045	0.191	0.008	465			
2130	12136	10	09	00	327700	296100	57700	4.714	0.454	0.064	0.493	80
16207	0	1377	3981	1489	1640	0.138	0.302	0.023	14982	1894	0	
0	904	0	0	200	1686	0.047	0.147	0.010	1012			
2131	21044	10	09	00	322300	283100	64700	4.689	0.439	0.057	0.416	51
13309	0	2191	3078	986	1584	0.318	0.306	0.018	13239	2608	0	
0	689	0	0	208	1680	0.037	0.127	0.007	585			
2132	12137	10	09	00	318400	295900	45800	4.660	0.437	0.055	0.355	81
11308	0	5106	2785	0	1609	0.349	0.367	0.030	12858	1827	0	
0	0	0	0	194	1671	0.050	0.198	0.017	900			
2133	21045	10	09	00	321600	282100	62200	4.766	0.457	0.059	0.419	52
14152	0	2192	3085	1136	1614	0.245	0.306	0.018	13100	1772	0	
0	0	0	0	206	1666	0.050	0.176	0.010	426			
2136	12139	10	09	00	315700	280000	57800	4.619	0.469	0.062	0.487	83
13164	0	2200	3234	0	1584	0.451	0.359	0.021	13026	2249	0	
0	0	0	0	195	1662	0.054	0.206	0.015	719			
2139	21048	10	09	00	323900	286900	53200	4.760	0.413	0.055	0.432	55
10319	0	6754	6253	0	1598	0.485	0.360	0.031	11990	2033	0	
0	0	0	597	202	1657	0.058	0.225	0.014	355			
2140	12141	10	09	00	324600	288700	57600	4.759	0.467	0.056	0.544	85
14974	0	5910	3630	0	1610	0.327	0.354	0.022	13630	1780	0	
0	0	0	911	197	1670	0.041	0.183	0.011	799			
2141	21049	10	09	00	319100	285900	52400	4.798	0.418	0.055	0.390	56
9260	0	6408	6252	0	1621	0.345	0.393	0.039	11980	1737	0	0
0	0	596	198	1666	0.059	0.243	0.016	355				
2142	12142	10	09	00	315900	280100	59900	4.667	0.422	0.055	0.459	86
13058	0	1569	3215	437	1614	0.298	0.355	0.029	13529	1775	0	
0	0	0	772	194	1666	0.054	0.201	0.015	830			

2144	12143	10	09	00	313500	282400	53600	4.651	0.415	0.056	0.333	87
11414	0	1496	2879	511	1610	0.322	0.361	0.039	13149	1602	0	
0	0	0	920	207	1660	0.055	0.230	0.021	708			
2145	21051	10	09	00	326100	287500	58200	4.718	0.399	0.055	0.436	58
9816	0	4955	5950	0	1609	0.416	0.383	0.034	12410	1887	0	0
0	0	109	200	1668	0.057	0.247	0.016	387				
2147	21052	10	09	00	321900	280600	59200	4.782	0.436	0.058	0.516	59
11178	0	6759	3477	0	1596	0.400	0.343	0.028	12125	1891	0	
0	0	0	546	198	1656	0.049	0.207	0.011	383			
2149	21053	10	09	00	322300	275100	67200	4.849	0.412	0.057	0.594	60
12772	0	6673	2998	0	1617	0.292	0.360	0.023	12562	1526	0	
0	0	0	0	198	1666	0.060	0.238	0.011	365			
2150	12146	10	09	00	298600	261500	53600	4.811	0.438	0.060	0.584	90
14505	0	6499	3566	2493	1608	0.304	0.334	0.018	12275	1763	0	
0	512	0	798	184	1657	0.047	0.167	0.009	762			
2151	21054	11	09	00	326600	282900	68900	4.741	0.432	0.062	0.536	61
19004	0	386	1196	1019	1621	0.478	0.376	0.031	13606	1852	0	
0	955	1957	0	198	1669	0.069	0.215	0.011	369			
2152	12147	11	09	00	323300	289500	49900	4.715	0.396	0.061	0.528	91
13605	0	7506	3387	392	1620	0.239	0.352	0.025	13186	1575	0	
0	0	0	0	197	1669	0.050	0.208	0.015	781			
2153	21055	11	09	00	327200	283400	70100	4.827	0.435	0.058	0.560	62
17733	0	3022	3933	1262	1627	0.192	0.285	0.015	14222	1396	0	
0	0	0	0	183	1660	0.054	0.161	0.007	480			
2156	21056	11	09	00	300500	255300	62400	4.801	0.403	0.059	0.513	63
9325	0	3588	6291	0	1579	0.512	0.354	0.026	11097	2049	0	0
0	0	1941	181	1634	0.046	0.173	0.011	482				
2157	12150	11	09	00	317500	277100	65200	4.801	0.410	0.060	0.541	94
14365	0	6102	4080	432	1577	0.288	0.304	0.019	13009	2642	0	
0	0	0	0	219	1673	0.036	0.117	0.009	1111			
2159	12151	11	09	00	321700	283800	71700	4.670	0.427	0.058	0.573	95
20006	0	0	4882	1499	1600	0.405	0.324	0.022	14299	2184	0	
0	0	0	0	195	1678	0.040	0.165	0.011	937			
2160	21058	11	09	00	308400	282300	56700	4.670	0.393	0.062	0.441	65
16195	0	899	3577	1428	1590	0.546	0.297	0.027	12813	2424	0	
0	0	0	475	190	1670	0.042	0.154	0.011	484			
2161	21059	11	09	00	325300	296900	53900	4.670	0.398	0.059	0.489	66
17415	0	3706	3873	1489	1602	0.213	0.223	0.010	13249	1798	0	
0	0	0	0	198	1657	0.042	0.127	0.007	503			
2162	21060	11	09	00	312800	281400	61300	4.574	0.374	0.058	0.473	67
14171	0	0	3076	1142	1596	0.234	0.263	0.016	12785	1751	0	
0	0	0	0	193	1651	0.045	0.145	0.007	480			
2169	12154	11	09	00	283900	258200	50000	4.660	0.408	0.057	0.474	98
11821	0	7622	2932	418	1628	0.176	0.288	0.024	11315	1146	0	
0	0	0	3969	173	1667	0.047	0.174	0.013	748			
2173	21067	11	09	00	294100	265400	50400	4.571	0.388	0.058	0.580	74
11831	0	6183	2950	0	1542	0.436	0.276	0.015	10887	2448	0	
0	0	0	1012	191	1617	0.042	0.091	0.005	647			
2174	12156	11	09	00	316800	281200	61600	4.593	0.380	0.057	0.521	100
13874	0	1987	3443	436	1600	0.275	0.291	0.027	13441	1986	0	
0	0	0	0	189	1670	0.037	0.128	0.012	1115			
2175	21068	11	09	00	331700	297300	58500	4.603	0.383	0.057	0.411	75
13926	0	330	3092	789	1601	0.422	0.323	0.028	13621	2055	0	
0	0	0	0	210	1670	0.058	0.186	0.011	439			
2176	12157	11	09	00	299400	274800	44000	4.510	0.376	0.057	0.368	101
10941	0	6006	2715	391	1545	0.401	0.230	0.013	11672	2518	0	
0	0	0	0	181	1630	0.043	0.105	0.007	945			

2177	21069	11	09	00	325100	297000	48500	4.539	0.355	0.054	0.302	76
10154	0	1038	3812	438	1594	0.517	0.342	0.045	12485	2383	0	
0	0	0	0	205	1680	0.044	0.202	0.017	645			
2178	12158	11	09	00	300500	281000	55300	4.600	0.357	0.054	0.358	102
10711	0	1710	2683	0	1601	0.182	0.247	0.014	12794	2181	0	
0	0	0	0	182	1674	0.040	0.098	0.007	1135			
2182	21071	11	09	00	321300	296200	47800	4.520	0.418	0.058	0.503	78
15495	0	1082	3618	995	1608	0.353	0.308	0.027	13700	2278	0	
0	0	0	501	202	1697	0.035	0.134	0.009	1059			
2186	21075	12	09	00	322400	290000	59800	4.571	0.395	0.056	0.435	82
14532	0	0	3253	502	1587	0.458	0.313	0.026	13076	2294	0	
0	0	0	0	206	1673	0.050	0.168	0.010	477			
2193	21078	12	09	00	302500	280000	35900	4.404	0.384	0.058	0.646	85
12941	0	6863	1981	0	1581	0.536	0.259	0.041	11345	1981	0	
0	930	2296	0	203	1636	0.061	0.150	0.014	563			
2194	12165	12	09	00	302700	279900	43300	4.334	0.387	0.059	0.690	109
14086	0	1235	3424	0	1594	0.496	0.284	0.048	13084	2420	0	
0	543	0	3001	185	1656	0.040	0.120	0.016	1026			
2201	21082	13	09	00	352700	270000	51500	4.401	0.345	0.056	0.543	89
10909	0	797	2830	0	1610	0.309	0.263	0.032	12330	1742	0	
0	0	993	2002	209	1650	0.043	0.139	0.014	952			
2210	21089	13	09	00	322300	294400	51800	4.516	0.396	0.058	0.496	96
16831	0	1994	3731	1491	1637	0.157	0.249	0.015	13813	1427	0	
0	899	0	0	215	1670	0.051	0.158	0.010	880			
2213	21092	13	09	00	318300	281700	56300	4.510	0.386	0.059	0.345	99
11106	0	2197	2721	620	1611	0.394	0.306	0.032	12767	1950	0	
0	0	0	0	224	1689	0.040	0.171	0.018	1003			
2215	21094	13	09	00	299800	276000	44800	4.532	0.390	0.062	0.407	101
13673	0	3945	3081	846	1579	0.307	0.252	0.013	12208	1874	0	
0	0	0	0	216	1653	0.048	0.127	0.007	825			
2217	21096	13	09	00	309500	281400	52200	4.407	0.376	0.059	0.406	103
16203	0	0	3563	911	1611	0.403	0.286	0.031	13076	2243	0	
0	330	0	0	221	1686	0.040	0.149	0.012	918			
2218	21097	13	09	00	307300	295100	44500	4.427	0.380	0.055	0.406	104
16004	0	0	3499	1442	1610	0.336	0.270	0.023	13296	2149	0	
0	416	0	0	220	1700	0.037	0.119	0.009	1099			
2219	21098	13	09	00	328700	293800	55700	4.670	0.398	0.059	0.409	105
17032	0	801	3761	1301	1628	0.268	0.269	0.017	14071	1723	0	
0	528	0	0	230	1689	0.041	0.143	0.009	841			
2220	21099	13	09	00	315200	293000	45400	4.471	0.363	0.056	0.323	106
13995	0	0	3067	1117	1626	0.231	0.274	0.032	13311	1675	0	
0	406	0	0	223	1686	0.044	0.156	0.012	918			
2223	21102	14	09	00	319300	292000	54700	4.651	0.373	0.055	0.335	109
13403	0	2983	3079	824	1592	0.462	0.309	0.034	12459	2322	0	
0	0	0	805	225	1667	0.056	0.173	0.014	566			
2229	21108	14	09	00	311000	275000	72900	4.497	0.385	0.058	0.594	116
12916	0	0	3073	0	1535	0.750	0.256	0.020	12058	3582	0	
0	0	0	484	222	1666	0.033	0.103	0.008	1276			
2285	21122	17	09	00	301100	277600	42900	4.439	0.401	0.059	0.503	8
11164	0	7332	3061	0	1560	0.464	0.277	0.024	11179	2223	0	
0	1401	0	1165	215	1627	0.045	0.093	0.007	949			
2287	21123	17	09	00	310900	278100	62800	4.488	0.360	0.055	0.369	9
12337	0	0	3059	0	1608	0.201	0.300	0.024	13303	1843	0	
0	919	0	728	223	1661	0.037	0.109	0.008	1129			
2291	21125	17	09	00	325600	277000	69400	4.766	0.407	0.056	0.684	11
16525	0	7259	4106	0	1601	0.162	0.232	0.014	13138	1603	0	
0	267	0	480	228	1641	0.047	0.115	0.006	859			

2301	21130	17	09	00	318800	305200	39500	4.433	0.389	0.056	0.489	16
13041	0	4514	3572	0	1594	0.373	0.297	0.024	12819	1710	0	
0	0	0	518	219	1660	0.050	0.172	0.011	718			
2307	21133	17	09	00	324300	287100	57500	4.594	0.388	0.058	0.698	19
13151	0	5188	3116	0	1635	0.250	0.291	0.042	13202	1575	0	
0	0	0	0	220	1688	0.042	0.160	0.016	1029			
2329	21141	18	09	00	322600	306000	42100	4.568	0.358	0.062	0.453	28
16029	0	2814	0	4523	1609	0.400	0.247	0.046	13450	2335	0	
0	864	0	0	229	1699	0.037	0.119	0.013	859			
2333	21143	18	09	00	298000	276000	39900	4.520	0.332	0.057	0.330	30
10400	0	4943	6244	0	1596	0.143	0.224	0.017	11317	1399	249	
0	890	1991	0	186	1628	0.042	0.103	0.007	687			
2339	21145	18	09	00	318800	300900	39800	4.641	0.368	0.061	0.587	32
18440	0	4610	4104	1499	1620	0.275	0.250	0.031	13281	1910	0	
0	0	0	0	206	1682	0.044	0.138	0.010	830			
2341	21146	18	09	00	319600	303600	38100	4.385	0.347	0.058	0.449	33
15329	0	1875	3066	704	1632	0.176	0.237	0.029	12859	1307	0	
0	0	0	0	203	1668	0.045	0.162	0.013	684			
2343	21147	18	09	00	326200	278300	64900	4.792	0.381	0.060	0.653	34
17112	0	7507	3328	0	1607	0.370	0.286	0.035	12434	1872	0	
0	0	0	0	199	1682	0.045	0.162	0.010	664			
2349	21150	18	09	00	326800	274300	72200	4.705	0.376	0.058	0.507	37
12148	0	813	3004	362	1643	0.298	0.341	0.051	12743	1451	0	
0	0	0	672	201	1673	0.067	0.241	0.028	370			
2351	21151	18	09	00	319300	298500	42600	4.670	0.383	0.058	0.494	38
12987	0	8629	3092	344	1610	0.421	0.309	0.038	12032	1950	0	
0	0	0	1019	203	1671	0.044	0.181	0.013	538			
2357	21154	18	09	00	325900	299500	46300	4.724	0.368	0.054	0.440	41
15330	0	6115	3355	1321	1629	0.229	0.276	0.027	13011	1607	0	
0	0	0	0	206	1675	0.049	0.180	0.012	578			
2362	21156	19	09	00	312700	292200	47200	4.631	0.299	0.055	0.293	43
11679	0	2335	2882	732	1571	0.267	0.221	0.018	11994	2329	0	
0	0	0	0	208	1668	0.036	0.096	0.006	675			
2365	21157	19	09	00	326700	284900	62100	4.603	0.346	0.055	0.363	44
12585	0	6497	2978	0	1537	0.191	0.176	0.004	12798	3000	0	
0	0	0	0	196	1662	0.030	0.063	0.005	1061			
2369	21159	19	09	00	311600	275500	61900	4.571	0.350	0.055	0.308	46
9787	0	0	3894	2	1571	0.400	0.299	0.029	12038	2096	0	0
0	0	0	205	1654	0.039	0.166	0.012	613				
2375	21162	19	09	00	308400	274700	53400	4.593	0.353	0.054	0.276	49
8636	0	205	5824	0	1605	0.295	0.349	0.032	12035	1691	0	0
0	0	703	200	1654	0.045	0.190	0.013	439				
2381	21165	19	09	00	317100	292100	51800	4.564	0.342	0.056	0.281	52
8512	0	0	4622	0	1590	0.432	0.321	0.029	12258	2604	0	0
0	0	0	204	1706	0.034	0.135	0.011	859				
2385	21167	19	09	00	317400	292100	47900	4.712	0.390	0.056	0.403	54
13064	0	4997	3078	491	1608	0.353	0.321	0.027	12431	2047	0	
0	0	0	0	199	1681	0.043	0.174	0.011	492			
2387	21168	19	09	00	321300	295700	42200	4.689	0.394	0.056	0.390	55
12823	0	6623	3076	502	1597	0.425	0.321	0.025	12169	2020	0	
0	0	0	217	194	1669	0.054	0.177	0.011	430			
2392	21170	19	09	00	302900	265300	52800	4.728	0.410	0.058	0.488	57
9372	0	6704	6921	0	1572	0.385	0.310	0.019	11403	2069	0	0
0	0	1521	188	1643	0.039	0.120	0.008	620				
2394	21171	19	09	00	296400	272200	44200	4.545	0.367	0.056	0.440	58
10418	0	5429	5192	0	1588	0.352	0.298	0.024	11339	1870	0	
0	0	0	1649	187	1636	0.043	0.130	0.008	555			



2399	21174	19	09	00	328100	292200	59100	4.696	0.417	0.056	0.419	61
12257	0	4299	3020		509	1610	0.400	0.395	0.033	13117	1992	0
0	0	0	646		201	1682	0.052	0.207	0.013	646		
2400	21175	19	09	00	323200	291000	54400	4.647	0.406	0.055	0.321	62
10855	0	3552	2677		521	1615	0.257	0.353	0.034	12938	1621	0
0	473	0	0		199	1682	0.045	0.192	0.013	683		
2405	21178	19	09	00	309700	272000	65400	4.772	0.432	0.060	0.579	65
18814	0	209	4330		991	1655	0.151	0.262	0.016	13664	1451	488
0	591	0	0		194	1705	0.039	0.142	0.008	762		
2409	21180	20	09	00	327200	300000	53900	4.664	0.395	0.053	0.405	67
15949	0	1096	3509		1125	1576	0.357	0.287	0.020	13542	2154	0
0	0	0	0		200	1658	0.043	0.144	0.006	528		
2422	21186	20	09	00	314300	296200	44900	4.628	0.358	0.054	0.402	73
17451	0	711	3866		491	1654	0.261	0.307	0.035	13809	1490	0
0	0	0	1799		192	1678	0.049	0.170	0.011	424		
2430	21190	20	09	00	308800	296800	39000	4.673	0.380	0.057	0.318	77
19252	0	1694	3783		1509	1627	0.360	0.310	0.039	13237	1917	0
0	899	0	0		189	1687	0.053	0.163	0.011	530		
2432	21191	20	09	00	291700	256900	53600	4.772	0.376	0.056	0.450	78
14813	0	5887	2882		0	1580	0.464	0.301	0.024	10790	2097	0
0	896	0	29		183	1649	0.050	0.153	0.007	466		
2438	21193	20	09	00	319600	294200	51300	4.750	0.375	0.055	0.500	80
20030	0	2483	4495		1497	1614	0.362	0.308	0.022	13381	1844	0
0	0	0	0		200	1672	0.077	0.204	0.011	270		
2440	21194	20	09	00	335300	298000	50000	4.791	0.361	0.056	0.480	81
18668	0	4111	3811		1503	1618	0.316	0.277	0.020	13191	1707	0
0	912	0	0		204	1667	0.063	0.162	0.008	353		
2442	21195	20	09	00	322000	297700	48300	4.744	0.379	0.057	0.456	82
18903	0	3953	4022		1503	1619	0.328	0.301	0.026	13133	1898	0
0	902	0	0		203	1678	0.058	0.168	0.009	418		
2446	21197	20	09	00	324000	288100	57800	4.862	0.377	0.056	0.556	84
17042	0	7044	3759		829	1613	0.253	0.267	0.016	12834	2054	0
0	0	0	0		205	1685	0.051	0.150	0.008	491		
2448	21198	20	09	00	324300	291500	54800	4.754	0.386	0.054	0.449	85
14538	0	6689	3265		484	1597	0.380	0.318	0.021	12549	1950	0
0	0	0	456		205	1659	0.054	0.184	0.009	444		
2452	21200	20	09	00	330000	289200	64700	4.718	0.378	0.055	0.467	87
14391	0	4246	3259		357	1603	0.292	0.314	0.016	13220	1957	0
0	0	0	0		215	1677	0.042	0.164	0.008	540		
2456	21202	20	09	00	320200	286100	58900	4.779	0.374	0.055	0.480	89
12714	0	6793	3066		0	1597	0.302	0.302	0.018	12077	1768	0
0	0	0	4		208	1653	0.055	0.195	0.009	436		
2458	21203	20	09	00	321900	289300	55500	4.798	0.383	0.054	0.420	90
11994	0	6152	5011		0	1595	0.415	0.313	0.020	12178	2059	0
0	0	0	99		209	1671	0.046	0.167	0.009	576		
2460	21204	20	09	00	298400	261800	53400	4.821	0.378	0.053	0.361	91
9188	0	6060	6178		0	1584	0.499	0.336	0.021	10928	2113	0
0	1387	2899	195		1619	0.048	0.151	0.009	550			
2466	21207	21	09	00	323800	288300	56900	4.744	0.380	0.056	0.416	94
13618	0	5271	2523		1023	1599	0.344	0.265	0.023	12915	1931	0
0	0	0	525		211	1668	0.048	0.139	0.010	713		
2468	21208	21	09	00	329000	295200	53500	4.766	0.371	0.054	0.398	95
13616	0	6854	3069		836	1619	0.233	0.280	0.018	13026	1612	0
0	482	0	523		214	1660	0.048	0.158	0.009	661		
2472	21210	21	09	00	298200	272300	41000	4.680	0.381	0.058	0.396	97
10044	0	8086	5505		0	1573	0.396	0.298	0.022	10887	2049	0
0	707	0	2493		199	1614	0.043	0.107	0.007	641		

2484	21216	21	09	00	322300	293800	50000	4.686	0.369	0.056	0.482	103
14714	0	6576	3780	879	1638	0.181	0.310	0.017	12990	1406	0	
0	911	2527	0	206	1666	0.044	0.174	0.009	628			
2488	21218	21	09	00	327200	291700	57500	4.705	0.362	0.054	0.351	105
13449	0	2370	3064	1015	1638	0.216	0.327	0.024	13180	1441	0	
0	0	0	0	208	1681	0.055	0.228	0.015	404			
2490	21221	21	09	00	321500	296000	51500	4.718	0.387	0.061	0.333	108
13468	0	1386	3069	857	1592	0.473	0.348	0.026	13235	2800	0	
0	0	0	0	209	1702	0.039	0.159	0.010	765			
2492	21220	21	09	00	325000	297600	50900	4.708	0.372	0.056	0.373	107
13916	0	3665	3070	958	1590	0.466	0.253	0.022	13004	2337	0	
0	0	0	0	206	1666	0.044	0.143	0.009	620			
2499	21223	21	09	00	315200	293100	53700	4.452	0.390	0.057	0.401	110
13547	0	1004	3092	0	1568	0.408	0.285	0.013	12644	2961	0	
0	0	0	0	230	1682	0.040	0.103	0.006	1160			
2514	21231	22	09	00	321600	296000	51000	4.587	0.365	0.058	0.390	118
9532	0	3018	3796	0	1608	0.456	0.358	0.038	12501	2145	0	0
0	0	1187	205	1669	0.050	0.200	0.020	709				
2516	21232	22	09	00	322000	282700	63300	4.750	0.402	0.061	0.695	119
13286	0	6529	3537	0	1601	0.359	0.300	0.021	12607	1953	0	
0	0	0	1405	206	1659	0.046	0.152	0.010	796			
2518	21233	22	09	00	300300	257200	58900	4.731	0.400	0.060	0.651	120
12524	0	5307	3088	0	1589	0.558	0.374	0.027	11600	2309	0	
0	0	1781	3021	194	1637	0.047	0.135	0.009	758			
2520	21234	22	09	00	330600	283900	64800	4.775	0.389	0.058	0.582	121
12187	0	6967	3463	0	1594	0.305	0.289	0.018	12652	2038	0	
0	0	0	1297	208	1660	0.048	0.132	0.009	791			
2522	21235	22	09	00	322200	291600	53000	4.820	0.390	0.056	0.482	122
17102	0	6785	3758	1496	1588	0.275	0.235	0.010	13300	1651	0	
0	1010	1087	0	211	1646	0.050	0.115	0.006	568			
2525	21236	22	09	00	291500	259800	66100	4.670	0.372	0.054	0.412	123
9104	0	2547	6650	0	1571	0.292	0.307	0.020	11590	1570	0	0
899	1951	0	192	1599	0.061	0.127	0.007	476				
2527	21237	22	09	00	295900	271000	43700	4.702	0.372	0.055	0.341	124
9043	0	7221	6504	0	1557	0.429	0.311	0.018	10935	2075	0	0
0	0	141	195	1645	0.045	0.142	0.009	796				
2530	21239	22	09	00	324200	293300	55800	4.814	0.392	0.056	0.461	126
15141	0	5710	3297	1287	1621	0.253	0.252	0.021	13019	1653	0	
0	812	0	0	211	1661	0.053	0.141	0.009	519			
2534	21241	22	09	00	324500	301800	42600	4.664	0.380	0.054	0.281	128
9726	0	4628	2501	1003	1603	0.400	0.289	0.029	12729	2647	501	0
0	0	0	203	1699	0.035	0.128	0.012	1290				
2536	21242	23	09	00	296400	262800	55000	4.699	0.401	0.057	0.516	129
11595	0	5646	4658	0	1564	0.443	0.322	0.018	11107	2149	0	
0	313	2443	0	189	1629	0.046	0.130	0.006	840			
2545	21247	23	09	00	329100	285400	67900	4.843	0.410	0.058	0.673	134
16131	0	5592	4400	0	1584	0.437	0.312	0.022	12934	2385	0	
0	421	0	144	200	1649	0.052	0.154	0.008	687			

## A4.2 Data set D2

Heatno	Chargno	date	Wbath	Gry	Gschrot	C_ry	Mn_ry	P_ry	Si_ry	Lnslf	
Lime1	dolm1	Ore1	Rslg1	Rdl1	T1	C1	Mn1	P1	O21	O22	lime2
dolm2	Ore2	Rslg2	Rdl2	Hlms2	T2	C2	Mn2	P2	Oact2		

2551	21249	23	09	00	306200	273200	50200	4.616	0.392	0.059	0.513	136
11354	0	7051	2809	0	1582	0.447	0.334	0.027	11411	1870	0	
0	865	2510	4	187	1633	0.048	0.156	0.009	589			
2553	21250	23	09	00	318700	294800	50800	4.446	0.331	0.059	0.629	137
12043	0	1797	2953	0	1647	0.143	0.291	0.034	13688	1451	0	
0	0	0	0	191	1695	0.047	0.164	0.015	756			
2555	21251	23	09	00	320900	294400	48900	4.545	0.371	0.055	0.282	138
11557	0	3535	2827	0	1606	0.295	0.322	0.023	12950	1836	0	
0	0	0	0	195	1679	0.043	0.180	0.012	686			
2561	21254	23	09	00	321200	294400	52000	4.590	0.347	0.056	0.528	141
15180	0	2600	3331	0	1609	0.392	0.303	0.039	12985	1813	0	
0	807	0	427	192	1661	0.050	0.153	0.010	564			
2563	21255	23	09	00	320700	308200	34600	4.539	0.384	0.058	0.453	142
15156	0	6804	2585	0	1611	0.382	0.299	0.025	12647	1811	0	
0	600	0	0	192	1662	0.053	0.174	0.009	445			
2565	21256	23	09	00	332600	294200	61600	4.619	0.397	0.057	0.493	143
15524	0	1842	2775	0	1637	0.346	0.346	0.029	13401	1854	0	
0	948	0	484	196	1671	0.062	0.198	0.010	407			
2571	21259	23	09	00	321800	293100	50400	4.642	0.383	0.057	0.452	146
15993	0	912	3529	1410	1655	0.217	0.307	0.040	13255	1741	0	
0	758	0	0	189	1691	0.045	0.173	0.013	570			
2573	21260	23	09	00	323300	294000	47400	4.650	0.344	0.056	0.376	147
14010	0	2915	3348	1106	1638	0.232	0.283	0.034	12792	1967	0	
0	1006	0	0	190	1687	0.044	0.144	0.010	560			
2581	21264	24	09	00	320700	296500	47000	4.667	0.368	0.055	0.367	151
10385	0	5425	6295	0	1608	0.390	0.322	0.027	12107	2659	0	
0	0	0	0	190	1698	0.036	0.150	0.012	941			
2583	21265	24	09	00	318800	293200	49500	4.606	0.340	0.053	0.255	152
9036	0	0	6122	313	1598	0.578	0.348	0.048	11999	3041	0	0
0	0	317	189	1711	0.038	0.168	0.015	906				
2585	21266	24	09	00	329400	293300	56600	4.798	0.374	0.052	0.293	153
10764	0	3470	6278	0	1626	0.260	0.370	0.030	12797	1921	0	
0	0	0	0	191	1695	0.035	0.206	0.015	685			
2587	21267	24	09	00	319200	295900	45500	4.632	0.383	0.055	0.367	154
10411	0	5238	5627	0	1606	0.404	0.334	0.032	12175	2187	0	
0	0	0	0	183	1684	0.046	0.181	0.015	612			
2593	21270	24	09	00	320500	303300	48600	4.728	0.374	0.054	0.368	157
12565	0	4173	3077	663	1607	0.533	0.321	0.027	12271	1917	0	
0	792	2570	0	181	1658	0.066	0.195	0.011	329			
2603	21275	24	09	00	312700	288600	53200	4.760	0.378	0.058	0.410	162
14501	0	4665	3287	999	1598	0.405	0.304	0.024	12430	2491	0	
0	0	0	0	181	1683	0.045	0.146	0.008	472			
2605	21276	24	09	00	318700	286800	58500	4.766	0.392	0.057	0.433	163
15011	0	2980	3345	982	1613	0.396	0.339	0.031	12790	2264	0	
0	0	779	0	182	1688	0.050	0.186	0.011	458			
2607	21277	24	09	00	325100	293100	57500	4.714	0.391	0.057	0.459	164
15339	0	2317	3262	1020	1644	0.208	0.297	0.024	13730	1508	0	
0	0	0	745	185	1679	0.064	0.195	0.013	427			
2618	21281	24	09	00	315500	292500	50400	4.622	0.390	0.057	0.383	168
14850	0	1676	3258	1260	1583	0.696	0.322	0.034	12491	2546	0	
0	1525	0	90	178	1646	0.087	0.200	0.013	288			
2625	21284	25	09	00	320800	289500	54900	4.727	0.362	0.056	0.373	171
12771	0	2423	2	911	1645	0.296	0.311	0.028	12851	1797	0	
0	4	0	0	179	1700	0.047	0.205	0.016	570			
2629	21286	25	09	00	318600	306100	42100	4.606	0.367	0.057	0.360	173
16770	0	2705	3532	1443	1624	0.302	0.293	0.030	12997	1821	0	
0	880	2039	0	179	1665	0.048	0.158	0.010	459			

2633	21288	25	09	00	323900	292300	54600	4.632	0.391	0.055	0.355	175
15533	0	3074	3105	1155	1611	0.316	0.319	0.024	13387	1982	0	
0	779	0	0	183	1675	0.042	0.149	0.008	517			
2639	21291	25	09	00	336700	292700	65700	4.728	0.402	0.056	0.434	1
14998	0	4356	3275	962	1596	0.266	0.290	0.015	13648	2150	0	
0	460	0	123	189	1673	0.041	0.118	0.006	546			
2640	21292	25	09	00	317600	291200	53400	4.702	0.391	0.057	0.405	2
12680	0	6525	5158	0	1574	0.556	0.308	0.031	11974	2640	0	
0	735	0	0	147	1654	0.049	0.168	0.009	491			
2642	21293	25	09	00	324800	291000	54100	4.625	0.359	0.060	0.341	3
11607	0	4724	2882	0	1597	0.399	0.294	0.051	12232	2343	0	
0	0	0	0	148	1676	0.037	0.159	0.015	625			
2645	21295	25	09	00	294200	266100	50500	4.670	0.353	0.057	0.294	5
9135	0	8440	6136	0	1525	0.470	0.231	0.016	10527	2593	0	0
0	0	536	136	1618	0.044	0.101	0.005	609				
2657	21300	25	09	00	298100	256800	60000	4.674	0.372	0.057	0.419	10
9099	0	4672	6116	0	1572	0.209	0.230	0.015	11657	1968	0	0
997	0	1000	140	1633	0.035	0.075	0.005	735				
2665	21304	25	09	00	324500	286400	60200	4.814	0.378	0.056	0.634	14
16349	0	5895	3576	0	1628	0.186	0.276	0.028	13197	1643	0	
0	0	0	0	161	1677	0.041	0.161	0.011	675			
2669	21306	25	09	00	324800	288800	57800	4.782	0.380	0.056	0.584	16
17386	0	5497	3901	0	1633	0.247	0.296	0.032	13092	1896	0	
0	0	0	761	150	1682	0.039	0.158	0.011	655			
2673	21309	26	09	00	322300	291500	54000	4.670	0.384	0.056	0.549	19
16017	0	3508	3521	459	1606	0.457	0.338	0.039	12849	2194	0	
0	204	0	0	148	1677	0.047	0.207	0.014	445			
2676	21310	26	09	00	322900	291700	52200	4.542	0.355	0.055	0.408	20
11699	0	4217	3079	0	1583	0.511	0.323	0.037	12247	1944	0	
0	0	0	98	145	1646	0.071	0.233	0.017	300			
2679	21312	26	09	00	322100	290500	56700	4.670	0.366	0.057	0.423	22
15010	0	3489	3285	809	1598	0.378	0.306	0.037	13101	2011	0	
0	0	0	386	149	1666	0.046	0.172	0.012	456			
2683	21314	26	09	00	322800	290500	60200	4.670	0.382	0.057	0.422	24
13960	0	893	3085	756	1619	0.359	0.358	0.043	13198	1847	0	
0	612	0	0	153	1671	0.052	0.217	0.014	413			
2684	21315	26	09	00	317600	299200	43600	4.670	0.373	0.056	0.528	25
18496	0	4249	3084	1224	1599	0.444	0.270	0.030	13225	2201	0	
0	0	0	0	153	1672	0.052	0.156	0.010	485			
2689	21320	26	09	00	299800	278100	43600	4.555	0.362	0.058	0.363	30
9555	0	6565	6457	0	1566	0.407	0.277	0.029	11408	2393	0	0
0	0	2276	142	1626	0.034	0.100	0.007	649				
2694	21323	26	09	00	330000	305200	47000	4.548	0.373	0.057	0.387	33
12619	0	2189	3089	751	1636	0.315	0.302	0.042	13244	1895	0	
0	0	0	693	156	1679	0.041	0.186	0.015	491			
2698	21325	26	09	00	321900	288200	56100	4.571	0.387	0.059	0.511	35
13990	0	2099	3073	0	1625	0.269	0.292	0.041	13000	1862	0	
0	500	0	601	145	1671	0.038	0.145	0.011	530			
2705	21328	26	09	00	321400	289300	53500	4.840	0.373	0.056	0.442	38
14034	0	4223	3171	1002	1628	0.349	0.294	0.034	12913	2019	502	
0	0	0	526	145	1676	0.043	0.162	0.012	480			
2711	21331	27	09	00	325900	289100	57300	4.727	0.377	0.056	0.410	41
12258	0	6893	3014	0	1610	0.248	0.271	0.029	13209	1796	0	
0	0	0	1518	149	1643	0.042	0.119	0.007	525			
2714	21332	27	09	00	329800	289100	62100	4.632	0.382	0.057	0.379	42
13306	0	0	3086	991	1631	0.446	0.337	0.059	13303	1913	0	
0	945	1145	0	150	1670	0.065	0.214	0.021	323			

2719	21334	27	09	00	322300	289900	55400	4.472	0.387	0.055	0.500	44
11177	0	2403	2757	0	1582	0.421	0.297	0.040	12625	2546	0	
0	0	0	0	160	1669	0.039	0.147	0.012	625			
2724	21337	27	09	00	329000	301600	47100	4.657	0.377	0.058	0.278	47
9554	0	5691	5026	0	1607	0.251	0.300	0.033	13205	1585	0	0
0	0	485	148	1646	0.059	0.186	0.016	375				
2726	21338	27	09	00	336800	287400	59100	4.593	0.366	0.059	0.385	48
12356	0	3013	2956	0	1612	0.185	0.284	0.036	13196	1817	0	
0	0	0	0	152	1654	0.038	0.145	0.007	433			
2728	21339	27	09	00	320200	290200	52400	4.689	0.364	0.057	0.260	49
8545	0	3474	4617	0	1607	0.247	0.319	0.032	13094	2064	0	0
309	0	0	144	1683	0.041	0.138	0.010	642				
2730	21340	27	09	00	318700	286000	53300	4.658	0.384	0.061	0.527	50
11448	0	6411	3608	0	1623	0.206	0.275	0.046	12608	1626	0	
0	534	250	0	140	1664	0.042	0.162	0.017	502			
2733	21341	27	09	00	322300	288300	57300	4.782	0.378	0.057	0.458	51
18019	0	802	4057	1492	1648	0.225	0.290	0.051	14104	1663	0	
0	772	0	0	150	1685	0.046	0.169	0.018	493			
2741	21345	27	09	00	319600	289200	53800	4.689	0.382	0.058	0.425	55
15030	0	1001	3207	1280	1639	0.189	0.328	0.037	13508	1553	0	
0	0	0	701	146	1674	0.045	0.192	0.014	486			
2743	21346	27	09	00	331100	289200	62200	4.811	0.392	0.057	0.521	56
17369	0	3756	3860	0	1666	0.111	0.287	0.026	13975	1267	0	
0	0	0	1014	150	1685	0.045	0.191	0.015	567			
2745	21347	27	09	00	325300	303500	41300	4.718	0.368	0.057	0.445	57
16378	0	6137	3612	0	1641	0.250	0.289	0.031	13443	1681	0	
0	512	0	0	155	1696	0.052	0.173	0.014	609			
2749	21349	27	09	00	324400	289000	60900	4.718	0.398	0.062	0.523	59
16502	0	2387	3309	0	1623	0.331	0.334	0.041	13339	2053	0	
0	0	0	454	146	1680	0.044	0.186	0.012	468			
2751	21350	27	09	00	330600	303100	47000	4.728	0.365	0.054	0.400	60
13358	0	7915	3073	1480	1576	0.414	0.238	0.036	12791	2366	0	
0	0	0	0	149	1660	0.048	0.145	0.011	467			
2753	21351	27	09	00	330000	287200	65400	4.760	0.402	0.060	0.512	61
16611	0	2216	3656	0	1627	0.243	0.324	0.032	13711	1729	0	
0	496	0	7	161	1685	0.044	0.181	0.012	567			
2755	21352	27	09	00	324900	289200	57200	4.708	0.387	0.059	0.461	62
15271	0	3209	3893	9	1632	0.198	0.321	0.031	13301	1769	0	
0	748	0	0	160	1685	0.038	0.179	0.012	634			
2756	21353	27	09	00	327800	286100	65900	4.615	0.379	0.059	0.452	63
14224	0	1949	3069	0	1614	0.280	0.349	0.045	13226	1883	0	
0	829	0	0	175	1665	0.043	0.183	0.014	615			
2757	21355	28	09	00	312300	301900	36900	4.641	0.374	0.056	0.431	65
14875	0	7219	3254	1000	1611	0.372	0.279	0.027	12152	1871	0	
0	0	0	987	148	1668	0.060	0.165	0.011	470			
2758	21354	28	09	00	328900	289200	60500	4.753	0.402	0.060	0.506	64
15998	0	4199	3503	0	1643	0.199	0.341	0.030	13435	1617	0	
0	946	1682	0	155	1674	0.043	0.176	0.011	590			
2759	21356	28	09	00	329300	287400	63800	4.683	0.399	0.059	0.519	66
14095	0	3685	3156	1006	1595	0.456	0.276	0.032	12779	2168	492	
0	0	0	1014	157	1650	0.046	0.150	0.009	420			
2764	21358	28	09	00	295400	259300	52600	4.702	0.389	0.057	0.385	177
10233	0	7404	5549	0	1552	0.481	0.329	0.023	10641	2348	0	
0	0	0	1013	140	1632	0.044	0.130	0.007	553			
2766	21359	28	09	00	296100	267400	44900	4.683	0.360	0.054	0.326	178
10696	0	5637	4921	504	1582	0.465	0.306	0.028	11032	1713	0	
0	0	0	1105	181	1626	0.054	0.176	0.011	400			

2777	21364	28	09	00	318400	287700	50100	4.666	0.382	0.059	0.399	71
14385	0	3321	3272	951	1631	0.230	0.293	0.031	13152	1655	0	
0	0	0	1011	160	1665	0.049	0.165	0.012	542			
2785	21368	28	09	00	302300	274300	46700	4.705	0.355	0.056	0.246	75
9308	0	5026	5775	1329	1567	0.384	0.264	0.025	11132	2114	0	0
0	0	497	150	1638	0.041	0.135	0.010	638				
2787	21369	28	09	00	326400	287400	61500	4.660	0.378	0.057	0.378	76
15075	0	2291	3351	1287	1589	0.355	0.302	0.033	13125	1807	0	
0	925	0	0	161	1651	0.043	0.151	0.009	591			
2790	21371	28	09	00	317300	286000	52500	4.689	0.402	0.057	0.328	78
11912	0	1803	3564	0	1615	0.455	0.330	0.042	12493	2271	0	
0	542	0	0	157	1697	0.040	0.189	0.019	858			
2796	21373	28	09	00	326400	286900	62800	4.638	0.393	0.058	0.197	80
11085	0	0	3284	638	1612	0.301	0.351	0.037	12996	2011	0	
0	832	0	0	163	1675	0.040	0.179	0.012	842			
2803	21376	28	09	00	327400	276700	68800	4.766	0.383	0.059	0.483	83
15530	0	2400	3275	1013	1628	0.218	0.312	0.034	13066	1450	0	
0	909	1820	0	162	1650	0.043	0.176	0.011	463			
2805	21377	29	09	00	317700	296100	43600	4.674	0.362	0.058	0.241	84
13127	0	4761	2797	671	1608	0.337	0.293	0.034	12327	1843	0	
0	0	0	773	158	1666	0.050	0.174	0.014	476			
2811	21380	29	09	00	322400	287000	58600	4.683	0.362	0.058	0.428	87
16136	0	2508	3594	1466	1602	0.356	0.320	0.031	12860	2226	0	
0	953	244	0	159	1657	0.050	0.149	0.008	489			
2813	21381	29	09	00	321400	285400	63700	4.744	0.367	0.058	0.453	88
17164	0	1988	3827	1504	1599	0.395	0.304	0.032	12997	2176	0	
0	527	0	0	161	1667	0.047	0.150	0.009	521			
2815	21382	29	09	00	298100	250200	66900	4.724	0.392	0.059	0.547	89
12495	0	6313	3074	1260	1559	0.654	0.220	0.022	10975	2680	0	
0	0	0	1763	151	1632	0.042	0.113	0.007	729			
2818	21383	29	09	00	322600	297800	47600	4.744	0.376	0.058	0.442	90
15787	0	5811	2414	1407	1599	0.355	0.278	0.025	13121	2736	0	
0	0	0	0	165	1700	0.034	0.120	0.008	643			
2828	21388	29	09	00	322400	284500	63200	4.740	0.395	0.060	0.485	95
16012	0	1412	4027	1429	1642	0.149	0.282	0.032	13599	1680	0	
0	750	0	513	159	1692	0.045	0.132	0.007	558			
2832	21390	29	09	00	318300	285100	54800	4.708	0.400	0.061	0.372	97
14495	0	2016	3060	1094	1627	0.180	0.279	0.030	13170	1917	0	
0	504	0	0	140	1680	0.035	0.131	0.010	610			
2834	21391	29	09	00	299700	258900	56000	4.699	0.394	0.062	0.387	98
10882	0	7076	3641	379	1572	0.401	0.274	0.021	11078	2113	0	
0	0	0	702	145	1635	0.045	0.139	0.008	528			
2836	21392	29	09	00	319400	302100	43800	4.715	0.390	0.060	0.432	99
18842	0	4009	4111	1495	1609	0.348	0.275	0.032	13305	2527	0	
0	0	0	0	157	1691	0.043	0.128	0.009	693			
2846	21396	29	09	00	329100	289000	69900	4.865	0.408	0.059	0.535	103
18404	0	3388	3825	1076	1578	0.463	0.292	0.026	13278	2576	0	
0	889	1944	0	160	1652	0.048	0.140	0.006	457			
2848	21397	29	09	00	300200	270200	44800	4.606	0.336	0.054	0.205	104
13337	0	7098	3015	785	1581	0.128	0.209	0.008	11708	2070	0	
0	851	3258	0	148	1642	0.030	0.075	0.004	650			
2854	21400	30	09	00	313300	285200	49500	4.526	0.299	0.055	0.136	107
10694	0	1322	5853	0	1621	0.141	0.251	0.026	12096	1657	0	
0	0	0	0	161	1673	0.033	0.136	0.010	784			
2856	21401	30	09	00	333400	300000	45100	4.766	0.366	0.055	0.283	108
12110	0	5483	2968	806	1591	0.477	0.292	0.031	12289	2315	0	
0	0	0	450	157	1662	0.052	0.171	0.012	449			

2858	21402	30	09	00	316500	288000	52400	4.638	0.361	0.057	0.299	109
12362	0	1015	3027		502	1610	0.286	0.312	0.040	12637	2101	0
0	0	0	0		152	1681	0.047	0.176	0.014	498		
2860	21403	30	09	00	315600	283300	49800	4.705	0.366	0.055	0.312	110
10506	0	2599	2982		5	1630	0.411	0.377	0.046	12020	1991	0
0	0	0	0		153	1693	0.050	0.245	0.020	496		
2866	21406	30	09	00	318900	282400	62600	4.497	0.344	0.057	0.271	113
11883	0	1198	1497		2	1564	0.354	0.274	0.025	12422	2819	0
0	0	0	0		158	1671	0.033	0.115	0.007	672		
2868	21407	30	09	00	335300	289000	69500	4.785	0.398	0.061	0.816	114
19423	0	7730	4351		0	1598	0.291	0.259	0.016	13482	2250	0
0	0	0	1499		164	1648	0.045	0.121	0.005	469		
2870	21408	30	09	00	326000	289000	58900	4.644	0.374	0.059	0.423	115
13377	0	3103	3077		582	1598	0.359	0.300	0.029	12970	2238	0
0	0	0	10		158	1674	0.039	0.165	0.011	550		
2872	21409	30	09	00	324800	283900	64300	4.711	0.351	0.062	0.316	116
11532	0	1687	2837		476	1591	0.322	0.311	0.025	12835	2296	0
0	0	0	0		166	1678	0.043	0.164	0.011	544		
2874	21410	30	09	00	321800	290900	53900	4.734	0.390	0.058	0.555	117
15293	0	6990	3321		0	1598	0.363	0.313	0.026	12746	2201	0
0	0	0	501		155	1660	0.045	0.156	0.008	424		
2887	21416	30	09	00	323600	302200	46900	4.664	0.340	0.055	0.186	123
9118	0	1109	5534		0	1586	0.411	0.322	0.034	12465	2606	0
0	0	0	156		1687	0.041	0.161	0.012	568			0
2891	21418	30	09	00	317400	284000	55300	4.555	0.344	0.057	0.212	125
12354	0	1108	3039		577	1593	0.384	0.284	0.040	12912	2258	0
0	0	0	0		153	1680	0.036	0.149	0.011	585		
2893	21419	30	09	00	326400	299700	49700	4.731	0.387	0.059	0.392	126
15587	0	5999	2790		1210	1612	0.141	0.223	0.013	13690	1993	0
0	0	0	0		168	1669	0.038	0.118	0.006	494		
2895	21420	30	09	00	325700	289100	60700	4.734	0.381	0.057	0.402	127
14887	0	1117	3229		1024	1643	0.154	0.305	0.036	13879	1506	0
0	451	0	3		155	1683	0.047	0.184	0.013	466		
2897	21421	30	09	00	326500	284800	64200	4.727	0.369	0.055	0.296	128
13725	0	1116	3094		903	1619	0.168	0.267	0.024	13496	1616	0
0	0	0	0		154	1669	0.042	0.162	0.010	501		
2899	21422	30	09	00	326700	302300	47100	4.676	0.350	0.055	0.260	129
12617	0	2806	3043		879	1620	0.214	0.276	0.033	13241	1690	0
0	621	618	0		156	1668	0.040	0.153	0.011	533		
2904	21424	30	09	00	297300	270100	44500	4.619	0.387	0.057	0.442	131
13112	0	8567	3077		608	1561	0.447	0.221	0.014	11208	2261	0
0	347	1263	0		142	1622	0.040	0.101	0.004	533		
2906	21425	01	10	00	312400	288000	48400	4.638	0.393	0.058	0.416	132
15950	0	1841	3945		1434	1618	0.255	0.322	0.028	13069	1670	0
0	0	0	750		148	1667	0.046	0.161	0.009	460		
2914	21429	01	10	00	323000	295100	48500	4.766	0.368	0.057	0.352	136
12393	0	6195	3047		842	1618	0.238	0.310	0.031	12817	1847	0
0	0	0	0		176	1675	0.049	0.185	0.013	603		
2923	21434	01	10	00	317300	278700	69500	4.724	0.377	0.057	0.360	181
14556	0	0	3202		1206	1585	0.447	0.316	0.040	12797	2356	0
0	0	0	643		168	1660	0.048	0.168	0.010	467		
2925	21435	01	10	00	324000	297700	54800	4.712	0.403	0.058	0.463	0
17292	0	1029	3845		1498	1593	0.245	0.292	0.030	13976	2507	0
0	0	0	0		177	1684	0.045	0.119	0.007	741		
2931	21436	01	10	00	310100	289800	44400	4.466	0.376	0.057	0.373	1
13800	0	501	3477		0	1603	0.415	0.302	0.047	12996	1886	0
0	0	0	111		169	1672	0.039	0.183	0.023	757		

2932	21437	01	10	00	323200	301200	44400	4.625	0.393	0.059	0.461	2
16006	0	6015	3509	0	1596	0.398	0.315	0.024	13007	1773	0	
0	0	0	242	175	1655	0.060	0.193	0.012	516			
2937	21439	01	10	00	331100	295200	60200	4.558	0.381	0.059	0.401	4
13006	0	1893	3074	0	1595	0.252	0.290	0.022	13381	1521	0	
0	0	0	211	187	1643	0.055	0.177	0.012	562			
2941	21441	01	10	00	295400	258700	62300	4.622	0.400	0.059	0.455	6
11817	0	5685	2681	426	1561	0.314	0.309	0.016	11530	1847	0	
0	0	0	0	167	1628	0.044	0.156	0.008	687			
2943	21442	01	10	00	322000	285500	62500	4.702	0.371	0.058	0.658	7
16509	0	3721	4418	1509	1630	0.128	0.204	0.015	14045	1243	0	
0	0	0	235	184	1662	0.045	0.124	0.008	709			
2944	21443	01	10	00	326800	279600	71900	4.775	0.366	0.057	0.569	8
15985	0	1203	3526	0	1618	0.240	0.313	0.022	13504	1589	0	
0	0	0	0	196	1655	0.054	0.203	0.012	516			
2946	21444	02	10	00	323600	295700	50100	4.472	0.360	0.056	0.363	9
14682	0	779	3178	0	1602	0.240	0.289	0.022	13321	1935	0	
0	0	0	0	185	1663	0.043	0.154	0.009	695			
2948	21445	02	10	00	332300	295200	51900	4.574	0.420	0.059	0.714	10
16815	0	5986	4216	0	1590	0.234	0.201	0.008	13449	2190	0	
0	0	0	0	189	1671	0.038	0.093	0.005	794			
2952	21446	02	10	00	301700	282400	40100	4.459	0.373	0.058	0.479	11
13430	0	5991	3061	421	1589	0.353	0.252	0.035	11711	1808	0	
0	1010	0	118	172	1642	0.040	0.121	0.012	852			
2954	21447	02	10	00	313100	287000	49000	4.488	0.332	0.055	0.331	12
11614	0	501	2883	724	1591	0.392	0.296	0.042	12509	2008	0	
0	947	0	0	177	1657	0.041	0.137	0.012	790			
2958	21449	02	10	00	322000	295800	47400	4.673	0.386	0.057	0.580	183
18916	0	2196	4240	1503	1663	0.144	0.277	0.038	13983	1307	0	
0	820	0	0	200	1693	0.048	0.165	0.016	694			
2960	21450	02	10	00	316800	299900	47500	4.286	0.359	0.056	0.381	184
12527	0	1257	2956	0	1570	0.244	0.206	0.006	12652	2308	0	
0	0	0	0	200	1650	0.042	0.091	0.004	840			
2965	21452	02	10	00	322500	296800	50900	4.561	0.377	0.063	0.555	186
18874	0	2047	3206	0	1612	0.147	0.252	0.011	13867	1983	0	
0	0	0	0	217	1690	0.037	0.102	0.007	1120			
2967	21453	02	10	00	318900	296400	46800	4.683	0.370	0.057	0.460	187
15978	0	4102	3957	0	1636	0.155	0.234	0.014	13076	1270	0	
0	0	0	0	205	1679	0.048	0.159	0.009	725			
2969	21454	02	10	00	317000	293000	49800	4.648	0.340	0.052	0.362	188
14474	0	2250	4034	1488	1615	0.175	0.272	0.041	13337	1661	0	
0	0	0	0	207	1679	0.044	0.134	0.012	788			
2972	21455	02	10	00	318900	292000	56600	4.395	0.335	0.055	0.479	189
10761	0	1256	2674	0	1570	0.727	0.156	0.010	12542	2709	0	
0	0	0	1114	203	1652	0.082	0.099	0.006	342			
2973	21456	02	10	00	321600	284800	61500	4.638	0.398	0.060	0.551	190
15997	0	4435	3578	0	1613	0.161	0.269	0.015	13086	1313	0	
0	0	0	0	192	1657	0.043	0.156	0.009	752			
2975	21457	02	10	00	308300	293300	44600	4.382	0.307	0.054	0.171	191
9492	0	0	4148	0	1582	0.355	0.275	0.043	12005	1809	0	0
0	0	0	188	1654	0.046	0.167	0.020	904				
2980	21459	02	10	00	327800	276600	72700	4.824	0.395	0.057	0.640	193
17522	0	2391	3903	0	1627	0.225	0.315	0.029	13526	1582	0	
0	400	0	0	195	1677	0.046	0.184	0.012	714			
2984	21461	02	10	00	320800	279600	62800	4.689	0.366	0.059	0.408	195
12995	0	2194	3077	0	1627	0.198	0.269	0.030	12917	1520	0	
0	0	0	0	189	1670	0.048	0.159	0.015	692			



2986	21462	02	10	00	325700	295300	51200	4.718	0.379	0.060	0.563	196
17645	0	4017	3940	1489	1645	0.258	0.303	0.033	13214	1415	0	
0	266	0	91	191	1678	0.052	0.198	0.015	592			
2990	21464	03	10	00	323500	296200	51000	4.670	0.384	0.064	0.499	198
16877	0	4103	3704	1211	1597	0.479	0.299	0.025	12928	2142	0	
0	608	0	0	198	1660	0.057	0.160	0.009	406			
2994	21466	03	10	00	329500	296200	55900	4.638	0.374	0.063	0.480	200
14846	0	3904	3293	595	1603	0.406	0.309	0.036	12801	1848	0	
0	0	0	0	198	1667	0.056	0.209	0.018	566			
2996	21467	03	10	00	312200	257800	70700	4.750	0.381	0.057	0.566	201
12222	0	7826	2996	0	1553	0.511	0.302	0.022	11122	2260	0	
0	0	0	545	192	1633	0.041	0.145	0.010	755			
3004	21472	03	10	00	327200	292400	58300	4.670	0.369	0.056	0.445	17
16470	0	1004	3610	1445	1614	0.374	0.315	0.045	13389	1827	0	
0	746	0	0	202	1666	0.057	0.200	0.019	489			
3008	21474	03	10	00	317800	294300	47400	4.670	0.404	0.060	0.626	19
19985	0	2603	4506	1497	1657	0.300	0.328	0.043	13688	1831	0	
0	893	854	805	199	1708	0.049	0.177	0.014	872			
3010	21475	03	10	00	323600	289900	53600	4.670	0.400	0.061	0.612	20
17617	0	6478	3915	2001	1594	0.490	0.296	0.024	12846	2231	0	
0	0	0	1029	201	1662	0.055	0.168	0.010	523			
3017	21478	03	10	00	318800	289700	50500	4.686	0.405	0.061	0.594	23
17732	0	8150	3919	820	1590	0.411	0.305	0.028	12867	2276	0	
0	0	0	544	202	1675	0.043	0.140	0.010	1144			
3019	21479	03	10	00	329700	290600	58800	4.670	0.394	0.057	0.465	24
16356	0	8461	3581	889	1603	0.199	0.283	0.023	13048	1740	0	
0	0	0	0	206	1657	0.049	0.166	0.011	773			
3021	21480	03	10	00	326100	293200	53200	4.670	0.394	0.057	0.465	25
13023	0	7677	2580	886	1598	0.298	0.289	0.025	12877	1717	0	
0	0	0	407	205	1658	0.045	0.153	0.010	687			
3027	21482	03	10	00	292400	258500	52500	4.670	0.370	0.057	0.402	27
9952	0	7304	5839	4	1541	0.436	0.259	0.013	11156	2233	0	0
0	0	0	189	1630	0.041	0.110	0.007	870				
3028	21483	03	10	00	297500	265500	50400	4.670	0.365	0.056	0.401	28
12127	0	7677	3000	1	1554	0.414	0.280	0.022	11239	2126	0	
0	0	0	0	189	1630	0.045	0.124	0.007	737			
3030	21484	03	10	00	325200	292000	55000	4.670	0.383	0.059	0.560	29
16852	0	5132	3718	779	1631	0.205	0.270	0.026	13435	1442	0	
0	0	0	1012	204	1655	0.051	0.175	0.012	635			
3032	21485	03	10	00	324700	289400	57100	4.670	0.385	0.059	0.497	30
12392	0	7458	3051	0	1585	0.509	0.285	0.026	12613	2052	0	
0	0	0	0	204	1652	0.062	0.193	0.016	470			
3034	21486	03	10	00	327600	290500	56300	4.670	0.351	0.054	0.392	31
11896	0	5639	2946	0	1609	0.310	0.306	0.035	12816	1641	0	
0	0	0	108	204	1656	0.052	0.208	0.018	527			
3035	21487	03	10	00	327600	284500	63900	4.670	0.358	0.054	0.397	32
11578	0	2592	2859	0	1624	0.220	0.295	0.028	13046	1515	0	
0	0	0	0	215	1672	0.049	0.200	0.016	726			
3039	21489	04	10	00	326000	302000	46900	4.670	0.395	0.057	0.430	34
14447	0	3484	3275	1192	1640	0.298	0.345	0.045	13600	1605	0	
0	0	0	604	204	1687	0.059	0.219	0.020	617			
3048	21494	04	10	00	317000	293500	46800	4.491	0.358	0.063	0.329	39
12050	0	1518	5458	541	1587	0.561	0.334	0.037	12385	2325	0	
0	0	0	0	203	1668	0.067	0.229	0.018	540			
3050	21495	04	10	00	322000	291700	49600	4.817	0.390	0.057	0.510	40
14889	0	6103	3291	1988	1627	0.493	0.325	0.043	12661	2070	0	
0	0	0	1166	214	1665	0.083	0.211	0.020	411			

3052	21496	04	10	00	325200	291200	57600	4.581	0.334	0.059	0.294	41
12123	0	1132	6522	433	1598	0.338	0.272	0.036	12730	2349	0	
0	0	0	0	211	1673	0.040	0.142	0.013	953			
3066	21502	04	10	00	312400	290300	44700	4.670	0.371	0.058	0.325	47
16056	0	3316	3305	1275	1597	0.374	0.284	0.036	12760	2156	0	
0	989	0	0	207	1664	0.049	0.143	0.010	762			
3067	21503	04	10	00	331500	290900	64100	4.670	0.383	0.056	0.416	48
17814	0	3545	3954	492	1621	0.287	0.295	0.033	13452	1830	0	
0	579	0	0	217	1674	0.048	0.160	0.011	669			
3071	21505	04	10	00	325600	290100	56900	4.670	0.359	0.057	0.340	50
11227	0	3008	3556	722	1615	0.335	0.359	0.036	12734	1929	0	
0	0	0	0	214	1675	0.052	0.234	0.018	570			
3073	21506	04	10	00	320800	288800	53100	4.670	0.385	0.058	0.420	51
16246	0	5468	3530	1478	1605	0.405	0.304	0.038	12934	2079	0	
0	0	0	487	212	1667	0.051	0.172	0.013	543			
3077	21508	04	10	00	324500	289100	59600	4.670	0.389	0.057	0.419	53
15579	0	5319	3408	1354	1617	0.309	0.326	0.031	12975	1880	0	
0	0	0	1196	214	1660	0.058	0.191	0.014	689			
3085	21512	04	10	00	332200	292200	59100	4.670	0.393	0.060	0.405	57
16164	0	2800	3559	1467	1632	0.190	0.268	0.028	13591	1553	0	
0	0	0	539	220	1669	0.043	0.166	0.012	560			
3090	21514	05	10	00	326600	286700	63800	4.820	0.371	0.057	0.432	59
17307	0	909	3828	1477	1586	0.459	0.284	0.026	13696	2503	0	
0	0	0	0	220	1673	0.044	0.143	0.011	818			
3093	21515	05	10	00	325500	287200	60600	4.744	0.372	0.059	0.463	60
17287	0	1306	5235	1492	1600	0.357	0.273	0.021	13499	2114	0	
0	0	0	0	217	1669	0.047	0.159	0.010	729			
3100	21518	05	10	00	320400	286200	63500	4.843	0.426	0.060	0.523	63
19301	0	1668	5132	1500	1621	0.290	0.298	0.024	13942	2010	0	
0	889	526	0	217	1678	0.049	0.145	0.009	662			
3103	21520	05	10	00	323100	291300	58300	4.766	0.385	0.058	0.608	65
20035	0	4737	4972	1270	1634	0.236	0.256	0.021	13700	1898	0	
0	889	568	0	222	1672	0.050	0.128	0.009	823			
3108	21521	05	10	00	312600	284800	54300	4.776	0.421	0.059	0.541	66
19199	0	2184	4787	1500	1599	0.449	0.306	0.021	13203	3330	0	
0	906	0	0	225	1713	0.040	0.109	0.008	777			
3112	21522	05	10	00	326900	299600	57900	4.689	0.422	0.057	0.352	67
14795	0	2806	3531	945	1582	0.473	0.308	0.022	13468	3027	0	
0	0	0	0	225	1691	0.045	0.135	0.010	1178			
3114	21523	05	10	00	311000	284000	54800	4.692	0.374	0.057	0.413	68
13336	0	3311	3050	609	1575	0.593	0.290	0.025	12509	2934	0	
0	0	0	515	226	1679	0.045	0.150	0.011	894			
3122	21527	05	10	00	322400	293100	58300	4.708	0.384	0.056	0.454	72
14043	0	2798	3096	602	1611	0.384	0.320	0.026	13341	1935	0	
0	0	0	545	221	1667	0.055	0.178	0.013	651			
3124	21528	05	10	00	322200	301900	47900	4.744	0.380	0.057	0.370	73
13571	0	4860	3092	823	1604	0.407	0.326	0.025	13028	2327	0	
0	0	0	0	223	1690	0.043	0.163	0.013	807			
3126	21529	05	10	00	320400	290000	58300	4.756	0.381	0.056	0.292	74
13397	0	1895	3096	1019	1593	0.467	0.314	0.032	13146	2241	0	
0	0	0	1218	224	1656	0.059	0.160	0.015	735			
3128	21530	05	10	00	315300	293100	51700	4.724	0.380	0.057	0.406	75
15997	0	1818	3483	1443	1618	0.369	0.304	0.028	13628	2001	0	
0	0	0	752	221	1691	0.044	0.154	0.011	753			
3130	21531	06	10	00	324200	299700	52400	4.833	0.379	0.054	0.419	76
16920	0	5101	3751	1495	1632	0.209	0.266	0.022	13875	1690	0	
0	0	0	1402	226	1683	0.050	0.142	0.010	825			

3136	21534	06	10	00	323200	295800	51900	4.754	0.393	0.057	0.408	79
16886	0	6028	3756	1500	1580	0.361	0.260	0.017	13293	1924	0	
0	0	0	496	226	1645	0.057	0.139	0.009	497			
3141	21536	06	10	00	318400	285800	57000	4.689	0.396	0.060	0.415	81
11995	0	4946	2949	538	1581	0.418	0.304	0.020	12656	2629	0	
0	0	0	0	216	1678	0.036	0.140	0.011	1155			
3142	21537	06	10	00	318700	287100	54600	4.727	0.386	0.058	0.486	82
10519	0	5475	4059	0	1608	0.385	0.342	0.036	12580	2196	0	
0	0	0	0	211	1690	0.037	0.178	0.019	1114			
3148	21540	06	10	00	321200	296700	48400	4.728	0.376	0.059	0.402	85
11135	0	6242	4682	0	1602	0.355	0.340	0.029	12726	2271	0	
0	0	0	0	211	1689	0.048	0.156	0.014	953			
3152	21542	06	10	00	318300	289700	56000	4.698	0.368	0.055	0.295	87
12426	0	0	3001	854	1595	0.485	0.318	0.035	12937	2249	0	
0	0	0	0	210	1674	0.046	0.175	0.017	748			
3156	21544	06	10	00	321900	288400	62400	4.715	0.374	0.057	0.353	89
14023	0	0	3039	1115	1617	0.380	0.359	0.047	13557	1844	0	
0	371	0	14	205	1674	0.053	0.209	0.021	582			
3158	21545	06	10	00	320700	290700	57700	4.667	0.380	0.057	0.366	90
13206	0	633	3055	0	1636	0.318	0.348	0.033	13453	1549	0	
0	325	0	526	204	1667	0.057	0.210	0.015	688			
3160	21546	06	10	00	321100	299100	50200	4.599	0.378	0.057	0.383	91
15119	0	324	3297	0	1633	0.375	0.360	0.037	13783	1850	0	
0	0	0	523	206	1677	0.058	0.225	0.020	648			
3161	21547	06	10	00	320500	296000	49900	4.747	0.399	0.059	0.501	92
16400	0	2510	3631	1484	1631	0.360	0.316	0.033	13562	1738	0	
0	0	0	496	206	1677	0.068	0.200	0.017	540			
3173	21551	07	10	00	309600	303000	41600	4.658	0.358	0.057	0.249	96
10394	0	3120	2994	589	1607	0.401	0.340	0.032	12434	1933	0	
0	0	0	743	206	1680	0.047	0.188	0.018	852			
3178	21553	07	10	00	324400	293000	61500	4.612	0.351	0.058	0.389	98
14104	0	0	3067	1052	1609	0.217	0.306	0.027	13751	1674	0	
0	0	0	420	215	1668	0.042	0.154	0.012	891			
3180	21554	07	10	00	311200	290800	48100	4.693	0.366	0.058	0.445	99
15249	0	4024	3353	1044	1626	0.233	0.273	0.020	13052	1308	0	
0	0	0	24	207	1668	0.065	0.183	0.012	647			
3182	21555	07	10	00	319200	299100	50700	4.674	0.346	0.058	0.411	100
16049	0	3217	3508	1187	1617	0.215	0.275	0.024	13464	1388	0	
0	0	0	92	214	1665	0.043	0.159	0.013	768			
3184	21556	07	10	00	324500	297500	55000	4.545	0.312	0.057	0.256	101
10496	0	0	3075	545	1594	0.240	0.285	0.027	13011	1811	0	
0	0	0	0	230	1668	0.048	0.148	0.013	855			
3186	21557	07	10	00	318400	292800	54100	4.670	0.338	0.059	0.342	102
10660	0	0	3066	530	1589	0.482	0.300	0.027	12430	1823	0	
0	0	0	535	214	1644	0.065	0.201	0.017	494			
3200	21564	07	10	00	315600	299100	39600	4.600	0.328	0.058	0.281	110
11130	0	3766	2757	647	1596	0.426	0.302	0.023	12446	2068	0	
0	0	0	0	207	1672	0.042	0.172	0.015	894			
3202	21565	07	10	00	320400	290100	58400	4.673	0.338	0.055	0.267	111
10727	0	0	3327	574	1599	0.524	0.319	0.031	12525	2367	0	
0	783	0	0	208	1667	0.051	0.177	0.016	624			
3209	21568	07	10	00	318900	292300	53600	4.728	0.394	0.062	0.653	114
18522	0	3783	4249	1315	1631	0.275	0.276	0.035	13384	1681	495	
0	0	0	1107	206	1669	0.046	0.149	0.013	749			
3210	21569	07	10	00	321300	301100	45600	4.552	0.355	0.058	0.433	115
15254	0	3787	3312	855	1594	0.487	0.286	0.024	12965	2247	0	
0	0	0	304	207	1670	0.047	0.166	0.012	735			

3216	21572	07	10	00	309900	297000	45600	4.680	0.342	0.057	0.454	118
13795	0	3786	3080	1500	1611	0.657	0.321	0.030	12473	2383	0	
0	0	0	1498	201	1670	0.062	0.192	0.016	505			
3226	21577	08	10	00	297600	251100	73400	4.849	0.426	0.062	0.739	123
16675	0	810	3724	1502	1644	0.157	0.347	0.028	12734	1271	0	
0	0	0	502	196	1672	0.051	0.224	0.014	760			
3232	21580	08	10	00	313600	289100	49200	4.673	0.359	0.057	0.434	126
16167	0	2019	3535	994	1662	0.153	0.253	0.028	13433	1246	499	
0	0	2079	449	203	1689	0.039	0.163	0.014	731			
3234	21581	08	10	00	320200	290000	52200	4.731	0.365	0.057	0.416	127
15596	0	1509	3397	992	1651	0.232	0.275	0.032	13382	1561	496	
0	0	0	1116	205	1691	0.043	0.169	0.013	637			
3236	21582	08	10	00	319300	297900	46500	4.690	0.396	0.061	0.534	128
18971	0	3767	4358	1000	1648	0.266	0.281	0.031	13349	1799	498	
0	0	0	1534	206	1686	0.044	0.154	0.011	666			
3242	21584	08	10	00	318300	298000	47200	4.683	0.368	0.058	0.407	130
15378	0	513	3365	1328	1621	0.531	0.316	0.044	12963	2226	0	
0	0	0	0	203	1704	0.046	0.210	0.021	799			
3247	21586	08	10	00	314600	286600	56000	4.641	0.366	0.052	0.333	132
12416	0	1003	3070	845	1592	0.466	0.304	0.017	12713	2664	0	
0	0	0	0	204	1683	0.045	0.139	0.009	897			
3251	21588	08	10	00	317400	297800	46300	4.715	0.379	0.059	0.431	134
15685	0	5386	3427	1108	1594	0.517	0.283	0.026	12907	2335	0	
0	0	4	220	205	1674	0.055	0.157	0.013	506			
3264	21593	08	10	00	322600	285500	60400	4.711	0.373	0.057	0.464	139
10534	0	3574	5491	0	1619	0.320	0.354	0.037	12883	1736	0	
0	0	0	379	212	1677	0.043	0.199	0.019	880			
3266	21594	08	10	00	325000	288200	55100	4.670	0.382	0.058	0.394	140
10718	0	3775	5117	308	1610	0.412	0.387	0.029	12636	1899	0	
0	0	0	603	210	1663	0.068	0.230	0.018	631			
3269	21595	09	10	00	309400	297400	39100	4.414	0.328	0.059	0.251	141
10857	0	1281	6293	408	1596	0.194	0.269	0.030	12325	1937	0	
0	572	0	0	205	1660	0.046	0.111	0.012	1120			
3276	21598	09	10	00	307500	288300	45100	4.548	0.317	0.056	0.278	144
15123	0	0	3273	1299	1600	0.331	0.253	0.038	12810	2275	0	
0	0	0	0	207	1691	0.042	0.116	0.010	1129			
3278	21599	09	10	00	308700	287000	48000	4.500	0.328	0.058	0.234	145
14123	0	1103	3100	1129	1594	0.373	0.275	0.029	12547	2106	0	
0	0	0	0	210	1673	0.038	0.134	0.011	1007			
3280	21600	09	10	00	317400	289000	56900	4.734	0.378	0.053	0.368	146
14719	0	2516	3288	1012	1601	0.494	0.318	0.027	12818	2109	0	
0	0	0	938	212	1659	0.063	0.206	0.017	483			
3282	21601	09	10	00	317100	288000	57700	4.705	0.377	0.054	0.332	147
12904	0	2905	3079	918	1604	0.395	0.330	0.037	12691	1982	0	
0	0	0	464	212	1672	0.054	0.178	0.015	658			
3289	21605	09	10	00	314200	298900	42500	4.443	0.315	0.054	0.256	151
10309	0	689	3083	484	1570	0.517	0.295	0.027	12078	2443	0	
0	0	0	98	210	1647	0.047	0.167	0.014	685			
3291	21606	09	10	00	316800	287000	54800	4.571	0.331	0.055	0.343	152
12530	0	1209	3077	830	1591	0.502	0.306	0.028	12477	2155	0	
0	0	0	99	214	1659	0.051	0.164	0.014	743			
3295	21608	09	10	00	318000	293100	58000	4.740	0.392	0.059	0.439	154
16992	0	6189	3784	1494	1587	0.365	0.280	0.021	13063	2030	0	
0	0	0	597	214	1656	0.051	0.140	0.010	788			
3297	21609	09	10	00	320400	286900	64900	4.746	0.384	0.058	0.360	155
14401	0	1503	3276	1169	1587	0.475	0.319	0.023	12881	2279	0	
0	0	0	1553	218	1651	0.042	0.141	0.010	768			

3299	21610	09	10	00	319100	287900	58400	4.683	0.327	0.056	0.366	156
13413	0	4004	3075		815	1579	0.458	0.287	0.025	12693	2013	0
0	0	0	886		214	1645	0.046	0.142	0.012	890		
3301	21611	09	10	00	331600	297000	59900	4.612	0.392	0.058	0.387	157
12588	0	5013	3090		855	1597	0.404	0.345	0.026	12876	2171	0
0	198	0	0		214	1673	0.046	0.169	0.011	843		
3306	21614	09	10	00	323000	295200	52800	4.602	0.376	0.058	0.412	160
13178	0	5217	3089		523	1579	0.412	0.287	0.019	13108	2238	0
0	501	0	0		214	1662	0.044	0.139	0.010	874		
3309	21615	09	10	00	295700	250700	68600	4.727	0.377	0.059	0.451	161
11653	0	2048	3020		533	1593	0.280	0.342	0.019	12073	1710	0
0	806	0	0		200	1646	0.044	0.148	0.009	825		
3311	21616	09	10	00	327500	287100	60600	4.766	0.363	0.053	0.287	162
11719	0	2405	2848		704	1626	0.161	0.300	0.024	13408	1469	0
0	0	0	0		211	1669	0.046	0.174	0.015	826		
3317	21619	09	10	00	322400	287800	55100	4.670	0.366	0.056	0.289	165
10311	0	3878	7003		502	1589	0.337	0.335	0.019	12739	1741	0
0	537	0	0		209	1652	0.047	0.164	0.010	753		
3321	21621	10	10	00	298900	253700	61300	4.786	0.394	0.060	0.389	167
10731	0	6072	3754		417	1586	0.238	0.317	0.014	11505	1830	0
0	0	1344	2073		200	1633	0.041	0.138	0.008	968		
3323	21622	10	10	00	297100	260500	57900	4.734	0.383	0.059	0.370	168
10119	0	3939	4997		354	1593	0.147	0.259	0.011	11780	1653	0
0	0	0	1215		200	1645	0.041	0.135	0.008	915		
3327	21624	10	10	00	318200	281100	67800	4.824	0.393	0.059	0.456	170
17395	0	2251	3384		0	1603	0.407	0.325	0.023	13227	1938	0
0	943	682	0		203	1661	0.051	0.163	0.009	714		
3331	21627	10	10	00	311500	295800	46200	4.670	0.354	0.055	0.287	173
10349	0	1195	3647		0	1620	0.340	0.314	0.043	13201	2371	0
0	0	0	0		201	1710	0.030	0.124	0.015	1110		

### A4.3 Data set D3

Heatno	Chargno	date	Wbath	Gry	Gschrot	C_ry	Mn_ry	P_ry	Si_ry	Lns1f		
Lime1	dolm1	Ore1	Rslg1	Rdl1	T1	C1	Mn1	P1	O21	O22	lime2	
dolm2	Ore2	Rslg2	Rdl2	Hlms2	T2	C2	Mn2	P2	Oact2			
3337	21631	10	10	00	296500	276500	51100	4.552	0.367	0.058	0.419	177
11858	0	3655	3075		491	1565	0.613	0.277	0.021	11597	2393	0
0	0	0	1805		182	1626	0.045	0.117	0.009	891		
3346	21635	10	10	00	307100	294300	38000	4.436	0.332	0.058	0.246	181
14985	0	0	3081		858	1584	0.555	0.267	0.042	12637	3193	0
0	0	0	0		220	1711	0.032	0.117	0.012	1522		
3352	21637	11	10	00	317900	295300	49200	4.427	0.338	0.058	0.256	183
11002	0	1020	2967		430	1567	0.383	0.246	0.025	13121	2210	0
0	579	0	0		211	1642	0.039	0.102	0.009	834		
3355	21638	11	10	00	324000	299300	49500	4.577	0.353	0.059	0.377	185
11222	0	2140	499		985	1584	0.490	0.293	0.031	13239	2337	0
0	939	1027	0		196	1655	0.051	0.155	0.014	700		
3361	21640	11	10	00	316400	295500	54800	4.497	0.332	0.061	0.486	187
16992	0	0	487		0	1587	0.377	0.246	0.032	13677	2617	0
0	0	0	0		213	1689	0.033	0.109	0.011	1106		
3363	21641	11	10	00	314600	295000	46200	4.616	0.376	0.060	0.514	188
15917	0	1512	3626		1461	1627	0.298	0.307	0.040	13839	1988	0
0	0	0	0		195	1704	0.036	0.161	0.017	1103		

3379	21647	12	10	00	307900	295500	41700	4.465	0.336	0.056	0.383	194
13589	0	984	3073	1033	1596	0.366	0.254	0.030	13053	2225	0	
0	0	0	0	205	1694	0.041	0.125	0.013	989			
3386	21650	12	10	00	320600	294100	53900	4.571	0.369	0.056	0.362	197
12582	0	1680	3084	623	1593	0.355	0.304	0.018	13442	1951	0	
0	0	0	0	213	1674	0.047	0.160	0.010	615			
3391	21652	12	10	00	323200	290600	46500	4.414	0.354	0.058	0.546	199
15841	0	602	3479	775	1641	0.127	0.226	0.016	13854	1348	0	
0	706	0	0	212	1672	0.039	0.133	0.009	767			
3393	21653	12	10	00	289500	250700	64000	4.625	0.383	0.061	0.649	200
12339	0	5619	3066	0	1565	0.327	0.277	0.019	11459	1997	0	
0	942	243	0	196	1630	0.044	0.112	0.007	882			
3397	21655	12	10	00	316900	292300	51700	4.584	0.326	0.056	0.305	202
11005	0	1081	2707	552	1595	0.247	0.284	0.025	12953	1990	0	
0	0	0	0	220	1669	0.038	0.134	0.012	1091			
3399	21656	12	10	00	315700	303200	39400	4.686	0.353	0.057	0.300	203
11921	0	8242	2657	403	1564	0.372	0.239	0.014	12269	2488	0	
0	0	0	0	220	1668	0.037	0.102	0.008	1010			
3403	21657	12	10	00	313600	291000	53100	4.465	0.323	0.054	0.271	204
11657	0	487	2840	361	1555	0.309	0.241	0.023	13118	2477	0	
0	0	0	0	217	1661	0.034	0.085	0.010	1352			
3404	21658	12	10	00	305800	292000	44500	4.549	0.370	0.056	0.365	205
13953	0	399	3060	925	1610	0.284	0.272	0.033	13174	2020	0	
0	0	0	344	205	1674	0.045	0.160	0.015	866			
3407	21659	12	10	00	307300	283100	64800	4.648	0.388	0.061	0.326	206
11457	0	0	2837	598	1575	0.568	0.323	0.026	12618	2615	0	
0	0	0	380	211	1647	0.050	0.171	0.013	685			
3411	21661	12	10	00	322300	293200	61100	4.737	0.361	0.058	0.504	208
18004	0	0	3981	1504	1631	0.171	0.242	0.017	14118	1570	0	
0	0	0	615	213	1674	0.058	0.151	0.012	697			
3413	21662	12	10	00	312500	290000	51000	4.622	0.360	0.058	0.398	209
15002	0	0	3278	1276	1602	0.329	0.279	0.027	13342	1944	0	
0	0	0	0	206	1674	0.047	0.158	0.013	641			
3416	21663	12	10	00	303600	283900	47800	4.763	0.408	0.058	0.545	210
19997	0	6746	4525	1499	1593	0.324	0.274	0.016	12658	1844	0	
0	576	0	1504	203	1649	0.054	0.124	0.006	857			
3419	21665	12	10	00	320800	288100	63000	4.705	0.370	0.057	0.436	212
15940	0	0	3251	750	1631	0.324	0.326	0.027	13570	1771	2038	
0	0	0	878	210	1677	0.048	0.201	0.016	821			
3422	21666	13	10	00	321100	293000	59400	4.744	0.391	0.059	0.489	213
18024	0	1288	4030	1504	1595	0.527	0.311	0.025	13353	2285	0	
0	0	0	1181	211	1660	0.054	0.163	0.010	643			
3426	21668	13	10	00	320000	290100	58400	4.577	0.376	0.059	0.500	215
16088	0	1793	3578	1462	1575	0.428	0.252	0.019	13302	2147	0	
0	491	0	0	229	1647	0.051	0.130	0.009	648			
3428	21669	13	10	00	322200	294000	57400	4.631	0.415	0.061	0.420	216
13421	0	2385	3006	1000	1614	0.314	0.315	0.027	13050	1867	496	
0	0	0	0	219	1671	0.049	0.188	0.014	849			
3431	21671	13	10	00	297400	260800	56700	4.721	0.412	0.057	0.299	218
8498	0	5850	5140	0	1579	0.441	0.295	0.033	10964	2083	0	0
0	0	1171	207	1629	0.064	0.145	0.010	451				
3433	21672	13	10	00	317300	298900	41900	4.682	0.385	0.058	0.339	219
11363	0	6312	2590	996	1591	0.385	0.296	0.027	12271	2204	493	
0	0	0	0	219	1675	0.047	0.168	0.014	968			
3436	10001	13	10	00	320200	296400	52100	4.769	0.414	0.059	0.523	46
16289	0	5269	5065	0	1642	0.236	0.319	0.032	15400	1349	0	
0	0	0	0	191	1684	0.058	0.178	0.012	336			

3438	10002	13	10	00	319400	289600	60800	4.619	0.404	0.058	0.440	47
11968	0	0	3951		0	1624	0.375	0.321	0.026	13449	1735	0
0	0	0	444		189	1672	0.066	0.205	0.011	242		
3439	21674	13	10	00	319500	278400	66600	4.891	0.407	0.058	0.548	221
13046	0	5754	3566		0	1588	0.353	0.295	0.018	12559	2478	0
0	0	0	0		219	1681	0.034	0.111	0.009	1269		
3441	10003	13	10	00	318000	307600	35800	4.583	0.401	0.059	0.382	48
14201	0	2736	3153		337	1641	0.324	0.302	0.020	13584	1688	1020
0	0	0	391		185	1683	0.088	0.198	0.012	260		
3442	10004	13	10	00	318300	298200	43900	4.670	0.418	0.059	0.419	49
12362	0	1108	2185		998	1662	0.380	0.378	0.044	13330	1878	0
0	84	0	0		169	1694	0.062	0.195	0.013	336		
3444	10005	13	10	00	311300	290400	47900	4.628	0.366	0.058	0.398	50
13491	0	2014	3442		1001	1630	0.382	0.301	0.031	13048	1841	504
0	0	0	1497		178	1674	0.062	0.156	0.009	378		
3445	21675	13	10	00	293400	262500	53000	4.622	0.351	0.060	0.427	222
9193	0	5036	4418		0	1573	0.559	0.290	0.034	11368	2046	0
941	2299	0	204		1624	0.057	0.133	0.014	764			0
3446	10006	13	10	00	325900	294600	54600	4.818	0.422	0.060	0.538	51
14441	0	5814	3519		999	1626	0.418	0.350	0.029	13083	2107	0
0	0	0	1503		192	1673	0.081	0.173	0.009	309		
3448	10007	13	10	00	309100	267300	68300	4.798	0.405	0.060	0.650	52
13284	0	3394	3311		0	1615	0.490	0.364	0.038	12193	2290	0
0	501	0	2175		183	1660	0.054	0.157	0.009	390		
3451	10008	13	10	00	320000	288900	56500	4.619	0.364	0.083	0.425	53
11303	0	3798	2831		0	1582	0.600	0.305	0.031	12319	2641	0
0	0	0	1138		189	1658	0.069	0.174	0.010	329		
3453	21678	13	10	00	321400	286900	63700	4.641	0.379	0.054	0.362	225
11069	0	2003	2708		0	1590	0.344	0.307	0.020	12876	2095	0
0	0	0	0		224	1661	0.046	0.161	0.010	916		
3454	10010	13	10	00	323300	289900	57800	4.818	0.403	0.060	0.507	55
13529	0	8927	3302		0	1612	0.409	0.333	0.030	13013	2193	0
0	0	0	1058		197	1685	0.056	0.154	0.010	591		
3456	10011	13	10	00	324000	285200	66600	4.670	0.395	0.060	0.427	56
12017	0	2429	2937		0	1611	0.467	0.351	0.034	12990	2104	0
0	927	1064	0		199	1674	0.074	0.190	0.013	472		
3457	21679	13	10	00	315800	289000	55600	4.673	0.375	0.059	0.510	226
14787	0	1822	3271		366	1629	0.148	0.267	0.025	13380	1492	0
0	300	0	0		215	1670	0.041	0.137	0.013	957		
3458	10012	13	10	00	318700	303300	40800	4.833	0.387	0.060	0.383	57
13423	0	5554	3323		1077	1647	0.463	0.330	0.034	13196	2065	0
0	495	0	0		209	1708	0.070	0.205	0.015	387		
3460	10013	13	10	00	291400	250000	62900	4.763	0.396	0.065	0.512	58
11747	0	9159	2919		0	1573	0.440	0.198	0.038	10554	2213	0
0	917	1105	0		192	1635	0.063	0.127	0.011	716		
3462	10014	13	10	00	318800	287000	60700	4.856	0.410	0.066	0.683	59
16347	0	4033	3990		704	1679	0.228	0.290	0.022	13465	1691	0
0	909	1420	0		209	1687	0.087	0.194	0.010	287		
3464	10015	13	10	00	318900	287000	59100	4.699	0.403	0.061	0.415	60
12654	0	2218	3107		888	1614	0.428	0.354	0.032	13202	2380	0
0	0	0	0		215	1704	0.050	0.179	0.012	657		
3465	21682	13	10	00	318900	288100	58900	4.760	0.376	0.062	0.470	229
15693	0	3711	3444		984	1605	0.285	0.288	0.019	13445	2034	0
0	0	0	0		217	1673	0.041	0.137	0.009	901		
3477	10021	14	10	00	290900	257300	58600	4.868	0.367	0.051	0.347	118
11011	0	6310	7448		499	1555	0.357	0.244	0.010	11175	1988	0
0	497	0	0		238	1638	0.052	0.109	0.005	533		

3479	10022	14	10	00	299600	252400	65600	4.776	0.368	0.064	0.446	119
11083	0	8066	3513	0	1572	0.399	0.261	0.023	11531	2073	0	
0	0	0	1701	240	1630	0.048	0.100	0.007	708			
3484	21689	14	10	00	322900	302700	42800	4.680	0.372	0.062	0.395	236
13340	0	4493	3035	896	1622	0.333	0.285	0.041	13312	1960	0	
0	0	0	0	230	1689	0.040	0.150	0.017	889			
3485	10025	14	10	00	314100	287900	58400	4.724	0.401	0.061	0.424	122
12496	0	6527	3104	320	1600	0.392	0.287	0.021	12938	2172	0	
0	0	0	968	246	1671	0.053	0.141	0.009	568			
3493	21691	14	10	00	322000	287100	62100	4.760	0.366	0.060	0.321	238
13799	0	1020	3382	942	1613	0.269	0.275	0.028	13813	1737	0	
0	0	0	0	207	1670	0.049	0.157	0.016	755			
3495	21692	14	10	00	321600	289100	60100	4.670	0.395	0.064	0.469	239
13347	0	0	3079	741	1648	0.472	0.299	0.038	13893	1905	0	
0	956	1651	0	206	1684	0.066	0.202	0.023	496			
3503	21693	14	10	00	317900	284600	54300	4.750	0.395	0.063	0.489	240
11537	0	7949	2843	0	1607	0.232	0.274	0.027	12581	1583	0	
0	234	0	0	204	1659	0.048	0.163	0.016	874			
3506	10035	14	10	00	322700	285200	64400	4.616	0.370	0.062	0.366	132
11037	0	1205	2683	0	1597	0.436	0.323	0.027	13084	2205	0	
0	0	0	601	245	1658	0.056	0.179	0.011	429			
3507	21694	14	10	00	317000	276400	62200	4.849	0.393	0.060	0.553	241
12721	0	7975	3075	0	1619	0.270	0.262	0.035	12498	1469	0	
0	657	0	0	206	1651	0.060	0.165	0.017	685			
3508	10036	14	10	00	321600	296700	49500	4.593	0.353	0.062	0.341	133
9901	0	5514	2947	0	1584	0.423	0.296	0.030	12665	2250	0	0
0	0	268	243	1663	0.051	0.157	0.012	565				
3509	21695	14	10	00	323700	277300	67400	4.833	0.373	0.059	0.551	242
13191	0	6216	3075	0	1623	0.156	0.245	0.028	12971	1366	0	
0	392	0	0	210	1650	0.049	0.151	0.015	876			
3510	10037	14	10	00	321200	289900	54400	4.641	0.347	0.062	0.386	134
10533	0	5304	2631	0	1597	0.280	0.281	0.024	12819	1907	0	
0	1	0	0	240	1660	0.052	0.165	0.011	480			
3512	10038	14	10	00	311300	275500	67500	4.830	0.391	0.059	0.472	135
11894	0	4419	2952	0	1639	0.265	0.317	0.032	12765	1524	0	
0	897	1061	0	235	1657	0.094	0.198	0.013	318			
3517	10039	14	10	00	307100	287000	61100	4.722	0.386	0.064	0.486	136
12142	0	2301	3063	0	1584	0.824	0.361	0.040	12254	2978	0	
0	902	494	0	229	1673	0.059	0.203	0.012	391			
3520	10041	14	10	00	314800	288100	55900	4.728	0.370	0.068	0.489	138
14976	0	3703	3450	729	1611	0.407	0.277	0.026	13365	2577	0	
0	0	0	0	237	1723	0.041	0.128	0.008	664			
3525	10043	14	10	00	321100	284600	61000	4.798	0.355	0.059	0.448	140
11313	0	6340	2750	0	1608	0.480	0.275	0.024	12445	2207	2	
0	958	5	0	239	1673	0.046	0.140	0.009	509			
3529	10046	15	10	00	316000	283000	58600	4.734	0.369	0.061	0.445	143
12514	0	3606	3069	996	1620	0.294	0.292	0.020	13002	1817	0	
0	222	0	12	230	1673	0.053	0.167	0.008	396			
3532	10047	15	10	00	324500	285000	61400	4.692	0.369	0.064	0.374	144
9325	0	2282	6695	0	1615	0.401	0.348	0.034	13196	2034	0	0
499	0	0	227	1684	0.048	0.184	0.014	517				
3534	10048	15	10	00	323900	300000	47500	4.709	0.338	0.066	0.287	145
10313	0	4881	5005	411	1609	0.351	0.310	0.024	13016	1988	0	
0	395	0	0	227	1671	0.061	0.176	0.011	396			
3536	10049	15	10	00	298200	260200	60200	4.721	0.354	0.062	0.293	146
11010	0	5239	2687	997	1542	0.450	0.231	0.010	11387	2294	0	
0	52	0	0	215	1629	0.054	0.117	0.005	388			



3537	21703	15	10	00	313900	296300	43700	4.772	0.378	0.064	0.347	126
12623	0	4379	3069	887	1616	0.306	0.311	0.041	12567	1805	0	
0	0	0	0	203	1677	0.051	0.176	0.019	943			
3538	10050	15	10	00	313100	287800	53500	4.670	0.351	0.060	0.262	147
12493	0	0	3103	1497	1604	0.429	0.276	0.024	13045	2172	0	
0	0	0	712	221	1663	0.057	0.158	0.009	372			
3540	10051	15	10	00	320900	300000	44800	4.718	0.395	0.063	0.402	148
14102	0	6412	3444	908	1613	0.282	0.257	0.013	13172	1802	0	
0	0	0	0	225	1660	0.063	0.168	0.008	321			
3542	10052	15	10	00	321800	289400	62300	4.738	0.360	0.056	0.435	149
16491	0	316	4016	2008	1634	0.169	0.223	0.012	14016	1662	0	
0	0	0	0	224	1674	0.060	0.153	0.008	394			
3544	10053	15	10	00	298900	267400	55000	4.574	0.387	0.064	0.403	150
9559	0	5494	5164	0	1538	0.590	0.282	0.010	11069	2691	0	0
468	89	0	215	1628	0.046	0.119	0.005	473				
3546	10054	15	10	00	317600	303200	39300	4.612	0.394	0.067	0.395	151
13527	0	5122	3309	1042	1608	0.436	0.319	0.023	12914	2329	0	
0	0	0	0	223	1693	0.057	0.184	0.011	386			
3547	21704	15	10	00	294500	283800	38200	4.670	0.363	0.062	0.446	127
15994	0	99	3501	1454	1604	0.608	0.327	0.048	11846	2103	0	
0	0	0	0	194	1685	0.058	0.215	0.023	634			
3558	21707	15	10	00	318400	301000	50200	4.817	0.389	0.072	0.548	130
20791	0	4947	4759	1502	1622	0.304	0.289	0.028	13601	1784	0	
0	0	0	1032	222	1679	0.084	0.167	0.013	725			
3561	21708	15	10	00	320200	287200	54900	4.727	0.376	0.059	0.325	0
12911	0	0	3072	930	1616	0.677	0.358	0.053	12299	2380	0	
0	0	0	518	220	1685	0.068	0.261	0.031	529			
3568	10063	15	10	00	317400	301400	42800	4.724	0.395	0.063	0.410	160
16674	0	2146	4063	350	1653	0.389	0.301	0.030	13715	1963	0	
0	329	0	0	230	1705	0.062	0.199	0.015	368			
3570	10064	15	10	00	315800	290100	52700	4.744	0.370	0.061	0.462	161
13886	0	2760	3453	1079	1643	0.333	0.284	0.024	13138	1870	0	
0	901	0	0	229	1686	0.053	0.161	0.010	332			
3574	10066	15	10	00	311300	299400	39000	4.744	0.399	0.055	0.353	163
16042	0	3319	3834	0	1645	0.285	0.289	0.027	12923	1857	0	
0	904	153	0	223	1692	0.048	0.164	0.010	416			
3591	10074	16	10	00	318800	287000	55700	4.766	0.381	0.060	0.359	171
9971	0	5311	2867	0	1602	0.496	0.314	0.023	12392	2286	0	0
0	0	487	227	1678	0.060	0.179	0.011	384				
3602	10079	16	10	00	322100	283000	64900	4.750	0.383	0.062	0.427	176
10895	0	1705	3559	0	1630	0.370	0.319	0.025	13248	2007	0	
0	0	0	798	236	1685	0.054	0.187	0.011	411			
3614	10085	16	10	00	323400	283700	61500	4.676	0.373	0.063	0.544	182
12893	0	3817	3178	0	1609	0.382	0.325	0.024	12989	2077	0	
0	870	0	0	229	1671	0.049	0.160	0.008	449			
3616	10086	16	10	00	320600	285700	58100	4.750	0.391	0.064	0.570	183
13623	0	5900	3369	0	1636	0.405	0.336	0.026	12727	1793	0	
0	904	3605	0	229	1647	0.070	0.189	0.008	299			
3620	10087	16	10	00	322500	279700	68100	4.795	0.369	0.060	0.492	184
11799	0	5728	2890	0	1567	0.375	0.281	0.014	12843	2814	0	
0	0	0	0	244	1669	0.045	0.143	0.008	544			
3624	10089	16	10	00	320800	286500	56300	4.779	0.366	0.064	0.411	186
12042	0	5455	2305	0	1624	0.351	0.319	0.021	12928	1966	0	
0	0	0	509	227	1669	0.060	0.196	0.011	395			
3627	10091	17	10	00	319200	281900	65400	4.657	0.381	0.062	0.420	188
11452	0	2012	2782	0	1611	0.243	0.269	0.016	13252	1867	0	
0	0	0	301	230	1653	0.047	0.151	0.008	418			

3631	10095	17	10	00	321500	294100	51200	4.334	0.355	0.063	0.390	192	
9243	3298	1503	498		0	1560	0.560	0.251	0.031	13477	3188	0	0
0	0	277	229		1681	0.036	0.114	0.009	737				
3633	10097	17	10	00	318200	293500	48000	4.376	0.330	0.061	0.265	194	
11744	0	293	2620		0	1594	0.501	0.292	0.028	13450	2340	0	
0	0	0	647		225	1663	0.049	0.154	0.009	440			
3636	10099	17	10	00	312800	275800	63900	4.622	0.368	0.062	0.404	196	
8634	3307	1187	533		0	1638	0.172	0.269	0.025	13466	1594	0	0
0	0	572	224		1668	0.051	0.164	0.011	415				
3639	10101	17	10	00	316100	279600	65000	4.654	0.390	0.065	0.633	198	
13449	4707	2009	955		0	1622	0.206	0.208	0.013	14021	1624	0	
0	0	0	0		223	1669	0.077	0.139	0.008	359			
3640	10102	17	10	00	313200	300700	45200	4.520	0.375	0.066	0.494	199	
13726	4705	3029	513		0	1630	0.223	0.184	0.013	14121	1636	0	
0	362	0	0		222	1667	0.072	0.133	0.008	299			
3642	10103	17	10	00	318600	292800	51800	4.661	0.379	0.062	0.585	200	
12217	4299	3592	939		0	1642	0.375	0.283	0.022	13310	1712	0	
0	1049	2489	0		223	1661	0.105	0.172	0.010	266			
3651	10107	18	10	00	318300	302900	42400	4.597	0.347	0.061	0.545	204	
8991	3084	4291	500		0	1634	0.449	0.283	0.034	13196	2066	0	0
0	0	0	226		1688	0.076	0.187	0.016	341				
3653	10108	18	10	00	325400	303200	45800	4.644	0.355	0.060	0.415	205	
8637	3096	2750	498		0	1655	0.381	0.326	0.041	13338	1971	0	1992
0	0	2196	230		1671	0.078	0.182	0.016	330				
3663	10113	18	10	00	316700	300200	44600	4.641	0.369	0.063	0.478	210	
10807	5175	2878	519		0	1665	0.306	0.312	0.041	13672	1791	0	
0	898	1963	0		210	1687	0.069	0.175	0.014	412			
3667	10115	18	10	00	324400	290000	61800	4.750	0.366	0.065	0.815	212	
16964	1113	4540	1873		354	1628	0.266	0.247	0.017	14056	1897	0	
0	0	0	0		214	1680	0.056	0.146	0.008	380			
3669	10116	18	10	00	321700	298900	52900	4.709	0.379	0.062	0.607	213	
13248	5994	4911	468		0	1646	0.348	0.269	0.022	14021	1920	0	
0	914	2314	0		213	1675	0.062	0.141	0.008	341			
3671	10117	18	10	00	318300	291400	51500	4.747	0.380	0.062	0.614	214	
12488	0	7588	3561		0	1612	0.414	0.264	0.019	12719	2189	0	
0	0	0	239		211	1674	0.053	0.142	0.008	417			
3673	10118	18	10	00	317400	286400	52300	4.756	0.371	0.069	0.597	215	
10776	4921	7179	0		970	1626	0.445	0.232	0.025	12780	2307	0	
0	0	0	1196		211	1678	0.056	0.126	0.008	430			
3675	10119	18	10	00	324300	294500	51200	4.760	0.377	0.063	0.643	216	
12060	5196	5757	494		967	1661	0.421	0.237	0.020	13563	1987	0	
0	0	0	1865		217	1700	0.088	0.142	0.009	316			
3677	10120	18	10	00	312100	300600	45000	4.670	0.368	0.060	0.492	217	
9268	4611	6493	0		980	1623	0.627	0.262	0.037	12620	2674	504	0
0	0	2532	201		1682	0.053	0.145	0.010	410				
3679	10121	18	10	00	331700	291600	62900	4.766	0.361	0.063	0.516	218	
11151	5989	4695	1063		0	1626	0.369	0.208	0.014	13987	2089	0	
0	901	727	0		200	1670	0.087	0.131	0.007	342			
3683	10123	18	10	00	318200	281700	63900	4.859	0.374	0.054	0.385	220	
7166	4348	5289	1056		0	1620	0.407	0.200	0.016	13124	2300	0	0
0	0	707	208		1688	0.049	0.121	0.010	557				
3685	10124	19	10	00	323800	289800	58000	4.817	0.402	0.062	0.409	221	
7700	4468	7691	997		0	1602	0.496	0.189	0.013	12985	2379	0	0
509	0	0	209		1681	0.049	0.114	0.008	557				

#### A4.4 Data set D4

Heatno	Chargno	date	Wbath	Gry	Gschrot	C_ry	Mn_ry	P_ry	Si_ry	Lnslf		
Lime1	dolm1	Ore1	Rslg1	Rdl1	T1	C1	Mn1	P1	O21	O22	lime2	
dolm2	Ore2	Rslg2	Rdl2	Hlms2	T2	C2	Mn2	P2	Oact2			
3687	10125	19	10	00	312200	289800	48100	4.647	0.368	0.060	0.428	222
12232	3	4978	3019	297	1623	0.259	0.280	0.021	13258	1789	0	
0	645	0	0	203	1674	0.049	0.149	0.008	447			
3688	10126	19	10	00	329700	297800	57600	4.673	0.375	0.062	0.424	223
8577	4436	4988	0	991	1607	0.378	0.279	0.023	13250	1909	497	0
603	0	0	207	1663	0.050	0.151	0.009	399				
3691	10127	19	10	00	316400	286900	56000	4.737	0.359	0.062	0.448	224
7562	4594	6328	1020	0	1599	0.560	0.185	0.018	12675	2284	0	0
704	92	0	202	1670	0.062	0.122	0.008	433				
3693	10128	19	10	00	319600	283600	64700	4.711	0.363	0.059	0.448	225
7323	4668	3709	974	0	1609	0.525	0.208	0.023	12841	2133	0	0
949	3	0	203	1657	0.074	0.150	0.009	346				
3695	10129	19	10	00	318200	276800	66900	4.791	0.384	0.058	0.461	63
7288	4368	6095	1067	0	1614	0.269	0.197	0.017	12971	1940	0	0
502	0	0	203	1660	0.047	0.113	0.008	583				
3708	10136	19	10	00	318200	283200	60800	4.721	0.368	0.063	0.518	70
7759	4488	5912	546	0	1647	0.271	0.252	0.032	12986	1519	0	0
901	759	0	176	1673	0.053	0.162	0.013	380				
3713	10138	19	10	00	320500	276300	67100	4.670	0.377	0.059	0.446	72
12941	4674	3640	510	0	1601	0.548	0.262	0.036	12454	2355	0	
0	917	5014	0	173	1632	0.069	0.156	0.008	327			
3715	10140	19	10	00	319900	272700	74500	4.670	0.375	0.057	0.483	74
7440	4405	4500	959	0	1577	0.556	0.168	0.019	12236	2644	0	0
518	0	0	175	1654	0.048	0.107	0.007	491				
3723	10144	19	10	00	322500	288400	54800	4.689	0.341	0.051	0.315	78
8161	4334	4017	0	0	1612	0.293	0.282	0.034	13025	1793	0	0
0	0	0	180	1672	0.047	0.165	0.012	492				
3725	10145	19	10	00	320300	286400	57800	4.616	0.391	0.052	0.460	79
9479	4526	4220	539	0	1605	0.437	0.277	0.030	12871	1906	0	0
0	513	0	169	1656	0.072	0.187	0.011	290				
3727	10146	19	10	00	317500	277000	64400	4.670	0.381	0.055	0.445	80
9086	4497	4296	517	0	1610	0.400	0.257	0.028	12746	1700	0	0
0	176	0	170	1655	0.070	0.174	0.011	309				
3729	10147	19	10	00	317900	288000	61700	4.715	0.371	0.054	0.443	81
10398	4593	3897	0	0	1609	0.467	0.248	0.025	13105	2164	0	
0	0	0	0	189	1672	0.078	0.173	0.013	294			
3731	10148	19	10	00	320500	275500	70700	4.747	0.378	0.054	0.454	82
8152	3519	3405	492	0	1616	0.290	0.284	0.025	12952	1707	0	0
0	4	0	172	1660	0.060	0.177	0.011	335				
3733	10149	19	10	00	326300	279600	72200	4.756	0.388	0.055	0.475	83
12340	0	3124	509	0	1625	0.210	0.255	0.020	13716	1633	0	
0	0	1487	0	182	1671	0.045	0.149	0.008	449			
3735	10150	20	10	00	326300	283800	66700	4.692	0.370	0.053	0.437	84
8371	4609	3705	581	0	1605	0.318	0.272	0.024	13391	1974	0	0
0	0	0	186	1675	0.046	0.149	0.010	503				
3737	10151	20	10	00	326100	285600	63300	4.689	0.383	0.054	0.457	85
9069	4994	3516	471	0	1633	0.361	0.293	0.029	13432	1736	0	0
898	994	0	186	1665	0.076	0.189	0.012	348				
3743	10153	20	10	00	319600	296100	49000	4.680	0.380	0.055	0.541	87
11164	5544	6295	535	0	1636	0.351	0.238	0.028	13422	1798	0	
0	615	130	0	188	1667	0.073	0.164	0.010	299			

3745	10154	20	10	00	320500	297000	48500	4.626	0.375	0.055	0.524	88
10509	5008	4487	531		0	1637	0.397	0.254	0.031	13604	1888	0
0	500	0	0		186	1671	0.088	0.182	0.012	240		
3747	10155	20	10	00	320700	289400	51900	4.770	0.373	0.055	0.446	89
9188	4308	7313	546		0	1634	0.324	0.229	0.027	13076	1853	0
563	0	0	185		1680	0.056	0.140	0.009	449			0
3749	10156	20	10	00	319800	290400	51700	4.667	0.373	0.059	0.385	90
8675	4313	5222	506		0	1624	0.427	0.305	0.035	12950	1888	0
895	88	0	185		1673	0.063	0.179	0.012	360			0
3751	10157	20	10	00	321600	292700	49600	4.737	0.351	0.064	0.446	91
8568	4215	7123	504		0	1612	0.516	0.252	0.020	12474	2216	0
628	0	0	215		1672	0.073	0.155	0.011	388			0
3757	10160	20	10	00	314300	295000	51700	4.779	0.345	0.060	0.545	94
14439	7938	2986	517		0	1663	0.402	0.218	0.021	14101	2182	0
0	988	4715	0		213	1682	0.084	0.115	0.006	365		
3759	10161	20	10	00	321300	287300	60000	4.705	0.345	0.060	0.660	95
11205	5809	5607	503		0	1614	0.523	0.255	0.018	12958	2659	0
0	527	0	0		218	1691	0.048	0.134	0.009	495		
3763	10163	20	10	00	326600	297200	50700	4.782	0.354	0.053	0.448	97
8601	4129	6092	527		0	1644	0.344	0.265	0.029	12937	1725	0
907	100	0	216		1682	0.062	0.171	0.012	340			0
3765	10164	20	10	00	322000	292400	50000	4.695	0.332	0.054	0.354	98
7781	4243	8594	479		0	1630	0.493	0.223	0.021	12780	2064	0
0	0	1224	213		1686	0.079	0.147	0.010	387			0
3767	10165	20	10	00	323200	294400	50000	4.731	0.399	0.062	0.603	99
12607	1	7837	3481		0	1627	0.295	0.302	0.021	13108	1793	0
0	0	0	0		213	1678	0.057	0.184	0.011	412		
3769	10166	20	10	00	319400	294300	50000	4.651	0.357	0.063	0.502	100
14487	0	2509	0		3635	1645	0.370	0.290	0.026	13760	2164	507
0	894	2470	0		244	1686	0.073	0.156	0.009	361		
3770	10167	20	10	00	317300	295200	50000	4.641	0.365	0.062	0.538	101
16805	0	4120	0		3663	1628	0.385	0.270	0.020	13345	2466	501
0	897	3443	0		249	1682	0.048	0.135	0.007	419		
3773	10168	20	10	00	321000	293800	47000	4.747	0.381	0.061	0.584	102
15525	0	7608	0		2662	1594	0.241	0.225	0.011	13054	2767	501
0	502	0	0		249	1694	0.045	0.111	0.005	634		
3776	10169	20	10	00	336100	291400	61800	4.584	0.337	0.064	0.399	103
9020	4508	200	460		0	1582	0.531	0.289	0.021	13330	2575	0
0	520	0	217		1653	0.058	0.164	0.009	374			0
3778	10170	20	10	00	316500	272500	75000	4.785	0.381	0.061	0.614	0
12694	5980	3291	993		0	1592	0.380	0.259	0.015	13259	2363	0
0	0	0	0		208	1660	0.058	0.133	0.007	384		
3780	10171	21	10	00	327900	291300	63500	4.680	0.385	0.064	0.602	1
9292	5238	6202	986		0	1585	0.520	0.160	0.017	13192	2487	0
0	41	0	216		1664	0.085	0.129	0.007	355			0
3782	10172	21	10	00	318300	290800	53200	4.574	0.372	0.062	0.507	2
8145	4576	6759	979		0	1581	0.599	0.167	0.019	12648	2665	0
0	2640	0	212		1655	0.059	0.106	0.006	462			0
3784	10173	21	10	00	317100	272700	72500	4.750	0.374	0.059	0.580	3
10517	0	5340	3143		0	1541	0.723	0.148	0.008	12216	3496	0
0	0	0	679		214	1660	0.043	0.083	0.007	780		
3786	10174	21	10	00	317900	274500	72000	4.801	0.390	0.059	0.515	4
9928	0	5666	2439		0	1587	0.411	0.177	0.016	12797	2199	0
0	0	0	203		1663	0.043	0.109	0.009	622			0
3790	10176	21	10	00	323600	288400	57400	4.650	0.368	0.060	0.562	6
9218	4961	2390	517		0	1665	0.357	0.276	0.032	13730	1565	0
899	3159	0	202		1673	0.089	0.189	0.013	345			0

3792	10177	21	10	00	323200	286200	60800	4.721	0.372	0.058	0.496	7	
8813	4591	4884	496		0	1624	0.412	0.237	0.030	13088	2034	0	0
0	0	557	200		1674	0.059	0.160	0.011	389				
3794	10178	21	10	00	332000	289300	63600	4.673	0.372	0.060	0.508	8	
9094	4707	4898	983		0	1632	0.343	0.203	0.017	13507	1866	0	0
0	0	765	207		1662	0.080	0.144	0.008	345				
3796	10179	21	10	00	322600	283800	60900	4.731	0.369	0.059	0.454	9	
7711	4467	5058	495		0	1626	0.295	0.288	0.027	13129	1866	0	0
0	0	0	200		1678	0.060	0.183	0.013	442				
3797	10180	21	10	00	320100	281400	63100	4.734	0.374	0.061	0.446	10	
7403	4480	4129	562		0	1605	0.494	0.227	0.028	12844	2421	0	0
0	0	463	198		1672	0.048	0.151	0.011	527				
3799	10181	21	10	00	329900	287500	61100	4.708	0.362	0.059	0.413	11	
7865	4512	4103	458		0	1620	0.398	0.309	0.026	13196	2137	0	0
0	0	640	202		1673	0.057	0.183	0.012	456				
3801	10182	21	10	00	319900	288100	56400	4.728	0.366	0.059	0.390	12	
7727	4313	7346	968		0	1604	0.361	0.179	0.012	12712	2072	0	0
0	0	0	203		1665	0.067	0.132	0.008	428				
3803	10183	21	10	00	321100	279100	64500	4.664	0.374	0.060	0.369	13	
7467	4452	3088	471		0	1592	0.424	0.310	0.024	13042	2148	0	0
0	0	0	203		1672	0.044	0.164	0.012	623				
3809	10186	21	10	00	320300	277800	67200	4.693	0.383	0.059	0.526	16	
8165	4446	4502	992		0	1598	0.499	0.202	0.025	12954	2223	0	0
519	1	0	198		1672	0.071	0.147	0.010	440				
3811	10187	21	10	00	317800	279000	68800	4.734	0.368	0.060	0.533	17	
7407	4528	4312	984		0	1626	0.453	0.195	0.021	13032	1921	0	0
891	2829	0	204		1651	0.063	0.124	0.008	435				
3813	10188	21	10	00	314100	282800	58600	4.686	0.359	0.057	0.435	18	
7890	4703	4293	994		0	1631	0.354	0.191	0.018	13191	1785	0	0
896	973	0	203		1660	0.071	0.133	0.008	379				
3815	10189	21	10	00	317900	277900	66500	4.820	0.365	0.055	0.531	19	
8128	4841	5996	976		0	1620	0.297	0.170	0.020	13134	1852	0	0
0	119	0	197		1663	0.048	0.119	0.008	458				
3818	10191	21	10	00	325200	294400	54900	4.708	0.368	0.059	0.511	21	
7202	4309	6907	529		0	1621	0.376	0.228	0.036	12959	2044	0	0
0	0	1001	202		1656	0.052	0.161	0.013	434				
3824	10194	21	10	00	322200	287000	56400	4.737	0.377	0.059	0.419	24	
7792	4387	4026	584		0	1645	0.212	0.278	0.030	13513	1508	0	0
0	990	0	199		1682	0.056	0.183	0.015	413				
3830	10197	21	10	00	313300	286000	53400	4.619	0.361	0.061	0.494	27	
8274	4420	2497	486		0	1665	0.284	0.329	0.040	13127	1657	0	0
391	2984	0	194		1692	0.059	0.211	0.018	357				
3834	10200	22	10	00	290100	250100	65000	4.766	0.387	0.059	0.572	30	
8638	4206	7607	529		0	1571	0.546	0.156	0.013	11102	2377	0	0
4022	0	1261	186		1635	0.051	0.099	0.005	480				
3835	10199	22	10	00	322900	281600	64800	4.692	0.361	0.060	0.453	29	
8870	4397	3712	1022		0	1614	0.567	0.196	0.017	12941	2137	0	0
895	2474	0	201		1645	0.104	0.139	0.007	302				
3838	10201	22	10	00	308500	279700	50000	4.779	0.352	0.056	0.415	31	
8729	4094	7091	558		0	1615	0.259	0.260	0.022	12560	1783	0	0
0	0	790	138		1657	0.044	0.125	0.009	586				
3841	10202	22	10	00	322000	270400	76900	4.756	0.384	0.061	0.499	32	
8158	4937	3403	476		0	1591	0.641	0.193	0.017	12942	2593	0	0
0	0	757	197		1670	0.063	0.114	0.008	512				
3842	10203	22	10	00	316900	285300	60800	4.686	0.356	0.059	0.418	33	
8942	4667	5886	524		0	1611	0.409	0.164	0.012	12856	2027	0	0
0	0	789	194		1667	0.060	0.101	0.006	454				

3844	10204	22	10	00	325100	282300	74600	4.654	0.381	0.058	0.472	34
8131	4951	3203	961		0	1577	0.440	0.162	0.016	13370	2372	0
0	0	694	195		1649	0.053	0.103	0.006	542			0
3846	10205	22	10	00	315900	274500	67800	4.660	0.382	0.057	0.472	35
7442	4413	5093	957		0	1572	0.407	0.149	0.012	12671	2492	0
0	0	0	185		1656	0.049	0.095	0.007	597			0
3848	10206	22	10	00	320900	272600	72100	4.647	0.373	0.058	0.455	36
7909	2993	3611	534	1987	1569	0.370	0.166	0.016	12951	2491	0	0
0	0	0	188		1648	0.060	0.120	0.008	431			0
3850	10207	22	10	00	321100	296700	47400	4.712	0.367	0.061	0.358	37
7936	4130	8490	980		0	1610	0.366	0.188	0.016	13086	1906	0
0	1481	0	188		1667	0.058	0.120	0.008	500			0
3852	10208	22	10	00	322200	278000	68100	4.708	0.391	0.061	0.465	38
8009	4506	3301	972		0	1609	0.376	0.249	0.039	13194	1990	0
0	1994	0	187		1657	0.049	0.156	0.012	456			0
3856	10210	22	10	00	317300	278800	67700	4.683	0.393	0.058	0.491	40
7919	4529	4193	993		0	1607	0.434	0.178	0.014	13083	2083	0
906	1004	0	195		1658	0.064	0.107	0.007	521			0
3858	10211	22	10	00	318100	274700	70500	4.721	0.389	0.057	0.542	41
8385	4597	5409	922		0	1596	0.438	0.179	0.016	12817	2195	0
903	1198	0	186		1646	0.052	0.105	0.006	560			0
3860	10212	22	10	00	318800	270100	75700	4.702	0.385	0.058	0.574	42
8439	4758	2497	1025		0	1625	0.341	0.263	0.038	13049	1858	0
499	993	0	186		1659	0.045	0.148	0.012	497			0
3863	10214	22	10	00	320000	282200	60900	4.728	0.336	0.057	0.429	44
8109	4313	6129	977		0	1589	0.435	0.166	0.016	13027	2245	0
0	1	0	184		1666	0.053	0.111	0.007	496			0
3866	10215	22	10	00	317800	275000	72500	4.647	0.386	0.060	0.505	45
8234	4576	3792	997		0	1586	0.454	0.169	0.012	12919	2246	0
0	1494	0	183		1646	0.052	0.107	0.006	419			0
3868	10217	22	10	00	316200	288100	53900	4.574	0.385	0.057	0.545	47
8215	4435	2901	490		0	1634	0.385	0.248	0.032	13322	1792	0
0	10	0	182		1674	0.067	0.172	0.013	362			0
3869	10216	22	10	00	327300	289700	62200	4.734	0.372	0.058	0.421	46
9366	4853	3000	996		0	1619	0.393	0.246	0.022	13843	2130	0
0	0	0	186		1679	0.061	0.154	0.010	427			0
3873	10218	22	10	00	322200	285500	61900	4.711	0.361	0.057	0.503	48
8182	4451	3005	505		0	1645	0.394	0.243	0.028	13697	1843	0
0	0	609	184		1688	0.075	0.166	0.013	376			0
3876	10219	22	10	00	320400	279100	65100	4.740	0.374	0.060	0.538	49
8126	4505	3606	958		0	1628	0.363	0.224	0.029	13495	1905	0
0	0	0	182		1685	0.059	0.154	0.013	460			0
3877	10220	22	10	00	322800	284600	62000	4.763	0.379	0.060	0.504	50
8353	4402	3500	994		0	1633	0.246	0.245	0.022	13744	1922	0
0	0	0	184		1682	0.054	0.145	0.010	489			0
3881	10222	22	10	00	320500	281700	58500	4.705	0.391	0.059	0.540	52
8534	4443	5101	1003		0	1633	0.374	0.202	0.024	13366	2031	0
0	0	98	181		1700	0.056	0.134	0.011	554			0
3883	10223	23	10	00	319900	293500	49300	4.660	0.355	0.059	0.552	53
9992	4913	5711	496		0	1620	0.209	0.193	0.021	13702	2171	0
0	0	0	183		1686	0.040	0.101	0.007	704			0
3884	10224	23	10	00	319700	281800	65100	4.706	0.377	0.058	0.513	54
9495	5106	803	553		0	1659	0.336	0.267	0.030	14073	1861	0
970	0	862	180		1701	0.048	0.138	0.010	558			0
3886	10225	23	10	00	320600	292200	53200	4.673	0.384	0.061	0.428	55
9720	4747	3501	969		0	1640	0.438	0.306	0.033	13466	2039	0
0	0	929	182		1690	0.063	0.185	0.015	388			0

3888	10227	23	10	00	316600	291500	53000	4.683	0.372	0.058	0.489	57
11041	5031	5397	991		0	1649	0.231	0.241	0.020	13635	1804	0
0	357	0	0		190	1700	0.047	0.138	0.010	554		
3894	10228	23	10	00	309100	286800	46700	4.603	0.370	0.059	0.426	1
10015	4975	5341	496		0	1601	0.433	0.262	0.022	12950	2127	0
0	0	0	0		195	1664	0.052	0.153	0.010	462		
3897	10230	23	10	00	323000	292600	52900	4.632	0.347	0.057	0.421	3
8648	4283	4601	502		0	1650	0.222	0.255	0.025	13541	1575	0
0	0	893	203		1682	0.054	0.153	0.012	489			0
3899	10231	23	10	00	324000	275500	66800	4.744	0.356	0.057	0.435	4
9409	3374	4596	505		0	1620	0.246	0.256	0.018	13192	1571	0
0	0	0	212		1665	0.054	0.148	0.009	440			0
3901	10232	23	10	00	304900	250800	77100	4.709	0.384	0.060	0.620	5
10723	2052	5797	988		0	1536	0.430	0.231	0.010	11630	2640	0
0	0	0	0		197	1629	0.039	0.105	0.005	540		
3903	10233	23	10	00	323300	282300	64600	4.689	0.369	0.060	0.492	6
9611	3769	3501	499		0	1634	0.281	0.315	0.029	13269	1704	0
0	0	469	202		1670	0.058	0.189	0.012	382			0
3905	10234	23	10	00	328400	287500	66200	4.689	0.361	0.060	0.444	7
9731	3139	3497	495		0	1627	0.311	0.323	0.028	13264	1795	0
0	0	651	204		1665	0.059	0.200	0.012	320			0
3907	10235	23	10	00	311300	266700	77800	4.842	0.372	0.057	0.574	8
9411	3990	3802	995		0	1613	0.586	0.180	0.014	12672	2389	0
0	0	977	198		1666	0.081	0.119	0.007	376			0
3911	10237	23	10	00	315800	274100	68700	4.728	0.342	0.057	0.449	10
8599	3121	5001	1017		0	1593	0.567	0.162	0.009	12767	2389	0
0	0	766	202		1663	0.064	0.105	0.006	446			0
3913	10238	23	10	00	324500	280000	70500	4.747	0.347	0.058	0.429	11
8645	3245	4502	510		0	1605	0.382	0.263	0.016	13033	1896	0
0	0	254	201		1655	0.062	0.161	0.011	355			0
3917	10240	23	10	00	310900	276600	64100	4.705	0.367	0.055	0.474	13
8651	3979	4227	531		0	1628	0.357	0.201	0.018	12763	1796	0
0	0	549	192		1665	0.070	0.152	0.009	338			0
3919	10241	23	10	00	302200	250800	74200	4.801	0.374	0.055	0.505	14
10355	2164	3993	530		0	1615	0.211	0.247	0.018	12172	1683	0
0	0	0	741		188	1622	0.042	0.118	0.004	433		
3920	10242	23	10	00	323900	284400	67100	4.820	0.367	0.056	0.431	15
10502	44	5711	986		0	1600	0.356	0.290	0.020	12951	2393	0
0	0	0	0		200	1683	0.040	0.151	0.011	499		
3922	10243	23	10	00	327300	283100	69600	4.750	0.360	0.057	0.457	16
9931	0	5607	2929		0	1573	0.632	0.182	0.008	12783	2990	0
0	996	0	201		1677	0.041	0.110	0.009	630			0
3926	10245	23	10	00	318500	277400	63100	4.850	0.369	0.055	0.411	18
7534	4869	4394	0		0	1627	0.192	0.248	0.018	13297	2158	503
0	0	0	197		1714	0.030	0.116	0.011	940			0
3927	10246	23	10	00	314000	276700	69200	4.856	0.330	0.052	0.501	19
7717	3824	4206	1526		0	1608	0.459	0.157	0.013	12748	2080	0
0	0	332	194		1680	0.049	0.103	0.008	509			0
3930	10248	23	10	00	311200	282500	62400	4.808	0.389	0.057	0.506	21
9012	3925	3793	1002		0	1623	0.599	0.212	0.018	12845	2366	0
0	4380	0	190		1675	0.089	0.147	0.010	360			0
3934	10250	24	10	00	322700	289900	60100	4.738	0.377	0.055	0.425	23
9453	4651	3489	827		0	1610	0.531	0.177	0.013	13453	2263	0
0	0	0	197		1683	0.109	0.143	0.011	311			0
3938	10252	24	10	00	319000	278400	68300	4.820	0.379	0.054	0.487	25
13226	0	2892	2763		0	1617	0.405	0.250	0.011	13529	2085	0
0	330	0	0		201	1685	0.063	0.161	0.010	423		

3949	10255	24	10 00	292700	253600	64900	4.833	0.367	0.054	0.389	28
12574	0	3800	3077	880	1579	0.161	0.222	0.006	12653	1589	0
0	0	0	197	184	1641	0.041	0.116	0.004	554		
3950	10256	24	10 00	324300	278000	71900	4.775	0.377	0.054	0.476	29
13316	0	1995	2000	819	1628	0.168	0.270	0.014	14090	1524	0
0	0	0	559	199	1658	0.047	0.153	0.006	479		
3952	10257	24	10 00	331400	288700	72700	4.625	0.341	0.054	0.432	30
10995	0	1496	3078	0	1581	0.319	0.283	0.023	13578	2106	0
0	0	0	0	197	1656	0.043	0.155	0.008	465		
3960	10261	24	10 00	325700	288000	66700	4.718	0.359	0.055	0.319	34
8348	4661	1605	502	0	1581	0.422	0.213	0.011	13265	2689	0
0	0	0	186	1668	0.055	0.122	0.007	477			0
3965	10263	24	10 00	315300	278100	65700	4.689	0.362	0.055	0.411	36
8597	4378	2003	477	0	1606	0.289	0.266	0.021	13567	2243	0
0	0	0	182	1682	0.041	0.138	0.010	664			0
3967	10264	24	10 00	330900	291500	70400	4.702	0.372	0.055	0.439	37
8966	4078	3298	986	0	1594	0.429	0.173	0.015	13602	2334	0
0	2059	0	193	1656	0.060	0.104	0.007	520			0
3971	10266	24	10 00	322100	289300	59000	4.731	0.364	0.054	0.454	39
8096	4659	3603	983	0	1603	0.387	0.156	0.011	13625	2289	0
0	0	0	189	1682	0.045	0.097	0.009	732			0



## Appendix 5

### Listing of optimization results

Table A5.1 Optimization results for dataset D1

Heat#	O22	LIM2	DOL O2	ORE 2	RSL2	RDO LO2	HL2	C2	T2	Mn2	P2	Oact2	Violations	Cost
1739	2240	0	0	0	0	1516	217	0.043	1625	0.105	0.007	618	-----	-----
OP#1	2283	400	0	0	0	0	250	0.0463	1645	0.135	0.0077	780	-T--P--	236.83
OP#2	2273	0	2000	0	0	1501	209	0.0464	1624	0.105	0.0061	639	-----	12.57
OP#3	2271	219	0	876	1877	0	222	0.0452	1625	0.1011	0.007	621	-----	10.36
1740	2339	0	0	0	0	463	214	0.046	1659	0.132	0.009	877	-----	-----
OP#1	2559	365	0	0	0	0	223	0.046	1670	0.1356	0.0089	877	-----	13.38
OP#2	2679	127	547	0	491	0	243	0.0461	1659	0.131	0.0079	878	-----	1.03
OP#3	2351	0	0	881	66	0	195	0.0456	1660	0.1295	0.009	763	-----	16.19
1741	1781	0	0	0	0	729	221	0.046	1662	0.124	0.006	644	-----	-----
OP#1	2173	416	0	0	0	0	250	0.0453	1677	0.1324	0.0065	806	----P--	130.72
OP#2	2029	0	999	0	0	1032	216	0.0511	1657	0.1234	0.006	755	-----	33.68
OP#3	2200	2	0	744	623	0	247	0.0462	1663	0.124	0.0048	642	-----	1.17
1743	1861	0	0	0	0	512	212	0.056	1656	0.14	0.011	631	-----	-----
OP#1	1779	1	2	0	0	0	224	0.0516	1656	0.1693	0.0093	630	-----	28.92
OP#2	2097	0	1994	0	0	497	250	0.0539	1651	0.1535	0.008	631	-----	18.21
OP#3	1975	16	1980	734	0	0	217	0.0509	1656	0.1399	0.0082	632	-----	9.69
1744	1475	0	0	0	0	1101	236	0.06	1654	0.209	0.013	352	-----	-----
OP#1	1100	0	0	0	0	0	250	0.0551	1661	0.2036	0.0116	462	-----	48.72
OP#2	1259	0	1986	0	0	375	241	0.0642	1652	0.2089	0.013	352	-----	8.77
OP#3	1100	352	0	38	7	0	250	0.0602	1654	0.2012	0.0122	352	-----	4.26
1745	1703	0	0	0	0	343	212	0.045	1666	0.141	0.014	865	-----	-----
OP#1	1968	0	0	0	0	0	196	0.045	1668	0.1432	0.0106	867	-----	3.67
OP#2	2143	43	280	0	7	458	228	0.0451	1666	0.1411	0.0106	865	-----	0.35
OP#3	1723	65	1998	99	0	0	197	0.0439	1664	0.1411	0.0126	863	-----	4.56
1751	1802	0	0	0	0	0	213	0.04	1685	0.149	0.01	886	-----	-----
OP#1	2075	421	192	0	0	0	250	0.0425	1685	0.1353	0.0087	885	-----	15.58
OP#2	2351	0	1064	0	0	0	232	0.04	1685	0.1257	0.0089	945	-----	22.45
OP#3	2012	0	166	220	2	0	222	0.04	1685	0.137	0.01	877	-----	9.15
1752	1995	0	0	460	0	0	238	0.05	1690	0.184	0.011	579	-----	-----
OP#1	1902	61	147	0	0	0	250	0.0511	1690	0.1714	0.0109	579	-----	9.05
OP#2	2273	0	2000	0	0	0	245	0.0513	1685	0.1581	0.0108	680	-----	39.1
OP#3	1894	146	0	62	0	0	250	0.0501	1685	0.1765	0.0107	600	-----	12.9
1755	1789	0	0	0	0	0	238	0.042	1703	0.152	0.009	524	-----	-----
OP#1	2036	0	0	0	0	0	250	0.0445	1704	0.1567	0.0102	672	----P--	171.17
OP#2	2038	0	2000	0	0	1001	249	0.051	1676	0.1416	0.009	706	CT-O-	398.68
OP#3	2349	0	0	1051	0	0	244	0.0417	1695	0.1225	0.006	688	-T----	89.83
1756	1564	0	0	0	0	0	235	0.044	1696	0.154	0.009	700	-----	-----
OP#1	2131	498	0	0	0	0	250	0.044	1704	0.1439	0.0105	862	----P--	206.05
OP#2	2349	0	1251	0	0	954	250	0.0454	1689	0.1276	0.009	804	-T----	62.38
OP#3	2058	62	0	538	237	0	240	0.0442	1696	0.1444	0.0087	697	-----	7.07
1760	2186	0	1	0	0	0	225	0.046	1683	0.154	0.012	769	-----	-----
OP#1	2209	30	999	0	0	0	248	0.046	1682	0.1476	0.011	770	-----	4.9
OP#2	2332	0	25	0	0	0	222	0.0459	1678	0.1448	0.0106	870	-----	24.13
OP#3	2224	0	29	23	0	0	250	0.0437	1680	0.154	0.0103	769	-----	8.2

1767	1505	0	0	0	0	176	224	0.052	1671	0.193	0.015	720	-----	-----
OP#1	1437	218	821	0	0	0	238	0.053	1671	0.193	0.0128	718	-----	2.14
OP#2	1716	63	250	0	738	360	195	0.0518	1671	0.1932	0.0138	720	-----	0.6
OP#3	1415	78	0	385	469	0	181	0.0521	1671	0.1906	0.0138	721	-----	1.65
1768	2068	0	0	0	0	534	231	0.053	1670	0.193	0.013	451	-----	-----
OP#1	1843	0	0	0	0	0	250	0.0546	1670	0.1978	0.0126	471	-----	10.12
OP#2	2195	0	2000	0	0	0	239	0.0544	1665	0.1866	0.013	454	-----	11.6
OP#3	2114	250	0	541	313	0	247	0.0532	1670	0.169	0.0105	453	-----	13.47
1769	2001	0	2002	0	0	0	214	0.048	1677	0.179	0.016	744	-----	-----
OP#1	2038	44	999	0	0	0	249	0.0473	1676	0.1773	0.013	744	-----	3.01
OP#2	2195	0	373	0	0	0	236	0.0484	1673	0.1769	0.0132	745	-----	6
OP#3	2090	0	4	22	0	0	236	0.0475	1676	0.1791	0.0135	740	-----	2.21
1770	2117	0	0	0	0	1	233	0.054	1669	0.186	0.012	454	-----	-----
OP#1	1823	0	0	0	0	0	250	0.0542	1664	0.1806	0.0099	479	-----	13.67
OP#2	1936	0	170	0	0	0	194	0.0548	1664	0.1748	0.012	585	-----	41.29
OP#3	2278	31	0	973	0	0	250	0.0544	1666	0.145	0.0065	454	-----	26.12
1771	1510	0	0	0	0	0	220	0.053	1666	0.163	0.011	712	-----	-----
OP#1	1525	127	497	0	0	0	237	0.05	1666	0.1632	0.0091	712	-----	5.76
OP#2	1589	31	373	0	5	180	198	0.0535	1666	0.1627	0.0103	712	-----	1.17
OP#3	1410	0	1496	0	0	0	216	0.0523	1663	0.1631	0.0106	710	-----	4.22
1777	1929	0	2003	0	0	499	206	0.059	1656	0.16	0.013	513	-----	-----
OP#1	1792	0	0	0	0	0	236	0.0536	1661	0.1899	0.0106	544	-----	40.27
OP#2	1997	0	983	0	0	950	250	0.0583	1651	0.1747	0.0099	514	-----	15.54
OP#3	1982	7	1249	957	98	0	214	0.0569	1656	0.1603	0.0091	512	-----	3.99
1778	2079	0	0	0	0	1027	229	0.042	1688	0.156	0.017	959	-----	-----
OP#1	2674	500	407	0	0	0	219	0.0473	1695	0.1559	0.0115	960	-----	19.89
OP#2	2830	317	219	0	301	8	206	0.042	1688	0.156	0.0121	958	-----	0.24
OP#3	2310	0	852	701	78	0	154	0.0416	1688	0.156	0.0128	957	-----	1.21
1780	1840	0	0	0	0	475	240	0.049	1658	0.178	0.012	500	-----	-----
OP#1	1723	2	0	0	0	0	245	0.0542	1663	0.1783	0.0098	498	-----	16.45
OP#2	1726	0	2000	0	0	0	167	0.0551	1656	0.1749	0.0119	506	-----	17.9
OP#3	1726	375	0	73	76	0	250	0.0509	1658	0.1656	0.0096	498	-----	11.21
1783	1950	0	1924	0	0	500	210	0.051	1639	0.141	0.008	803	-----	-----
OP#1	2073	498	0	0	0	0	250	0.0463	1651	0.1486	0.008	816	-----	27.78
OP#2	2209	422	1261	0	93	47	250	0.0495	1639	0.141	0.0071	803	-----	3.02
OP#3	2173	0	4	516	1720	0	236	0.0467	1639	0.1269	0.008	691	-----	33.5
1784	1749	0	0	0	0	0	234	0.049	1648	0.172	0.011	585	-----	-----
OP#1	1672	68	110	0	0	0	250	0.0507	1648	0.167	0.0092	585	-----	6.41
OP#2	1726	0	2000	0	0	0	178	0.0508	1643	0.1584	0.0105	586	-----	16.5
OP#3	1723	249	0	1	0	0	248	0.0494	1648	0.1556	0.0102	586	-----	10.59
1789	1689	0	0	0	0	0	240	0.043	1673	0.153	0.008	561	-----	-----
OP#1	1958	139	0	0	0	0	250	0.0444	1687	0.138	0.008	723	-----	59.36
OP#2	1955	0	2000	0	0	0	234	0.0499	1670	0.1382	0.008	711	-----	55.21
OP#3	1726	374	0	349	0	0	250	0.0441	1669	0.1255	0.0066	579	-----	28.13
1791	1718	0	0	218	0	49	239	0.059	1677	0.168	0.01	398	-----	-----
OP#1	1471	0	0	0	0	0	250	0.0535	1672	0.1957	0.0106	493	----P--	115.37
OP#2	1850	0	1908	0	0	547	250	0.0566	1667	0.1707	0.01	559	-T-----	103.48
OP#3	2004	0	0	1095	0	0	250	0.056	1672	0.1556	0.0065	422	-----	23.56
1792	2018	0	0	0	0	0	233	0.053	1688	0.17	0.012	696	-----	-----
OP#1	2195	250	307	0	0	0	250	0.0495	1688	0.1694	0.0114	696	-----	7.18
OP#2	2349	0	0	0	0	231	236	0.0509	1682	0.1724	0.012	692	-T-----	23.06
OP#3	2185	0	1470	123	27	0	238	0.0492	1688	0.1701	0.0113	693	-----	7.7

1793	1756	0	0	0	0	0	244	0.056	1671	0.185	0.013	601	-----	-----
OP#1	1762	0	360	0	0	0	242	0.0516	1671	0.1937	0.0121	600	-----	12.85
OP#2	2021	0	970	0	0	235	250	0.0548	1667	0.1876	0.0122	600	-----	7.33
OP#3	1899	1	1437	4	252	0	247	0.0543	1671	0.1851	0.0123	599	-----	3.53
1795	2287	0	1989	0	0	0	228	0.041	1683	0.153	0.017	962	-----	-----
OP#1	2427	470	0	0	0	0	223	0.0437	1686	0.1542	0.0113	961	-----	10.31
OP#2	2664	308	57	0	0	0	245	0.0411	1683	0.1503	0.0118	964	-----	2.18
OP#3	2087	14	1365	140	76	0	183	0.041	1683	0.153	0.0143	962	-----	0.05
1801	2235	494	0	0	0	0	224	0.048	1688	0.144	0.01	1058	-----	-----
OP#1	2097	344	379	0	0	0	250	0.0408	1683	0.1424	0.01	911	C-----	74.86
OP#2	2332	0	29	0	10	278	250	0.0405	1683	0.1314	0.01	1022	C-----	45.33
OP#3	1975	0	1971	536	0	0	202	0.0395	1676	0.1173	0.01	895	CT----	174.71
1803	2610	502	1267	0	0	0	220	0.034	1679	0.118	0.011	1165	-----	-----
OP#1	2796	236	0	0	0	0	186	0.0361	1691	0.1179	0.0102	1166	-----	18.81
OP#2	2852	31	500	0	621	47	247	0.034	1679	0.1181	0.009	1162	-----	0.61
OP#3	2378	0	156	705	0	0	180	0.0341	1677	0.1178	0.011	1020	-----	15.16
1804	1750	498	0	0	0	0	229	0.044	1684	0.143	0.009	983	-----	-----
OP#1	2036	500	0	0	0	0	250	0.0391	1697	0.1317	0.0097	959	---P--	110.16
OP#2	2195	293	774	0	22	680	250	0.0409	1680	0.1264	0.009	983	-----	22.28
OP#3	1843	0	0	1054	0	0	192	0.0412	1683	0.123	0.009	825	-----	37.26
1806	2296	503	0	0	0	0	207	0.045	1687	0.13	0.009	875	-----	-----
OP#1	2273	500	6	0	0	0	247	0.0441	1690	0.132	0.009	873	-----	6.53
OP#2	2461	0	0	0	37	250	250	0.045	1685	0.1299	0.0089	873	-----	2.3
OP#3	2158	11	1500	218	154	0	236	0.043	1687	0.13	0.009	787	-----	14.57
1808	2455	0	0	495	0	0	248	0.053	1664	0.177	0.01	721	-----	-----
OP#1	2280	500	0	0	0	0	244	0.0523	1669	0.1777	0.01	721	-----	6.63
OP#2	2349	51	25	0	613	547	213	0.0531	1660	0.1581	0.01	721	-----	15.4
OP#3	2197	0	4	766	93	0	197	0.0521	1664	0.16	0.01	663	-----	21.08
1809	2553	0	0	0	0	0	209	0.052	1668	0.139	0.011	916	-----	-----
OP#1	2525	125	27	0	0	0	187	0.0467	1666	0.1537	0.0109	916	-----	22.81
OP#2	2662	0	0	0	0	497	234	0.045	1664	0.1497	0.0102	823	-----	36.64
OP#3	2432	0	2000	608	0	0	205	0.0455	1663	0.1399	0.0106	775	-----	34.46
1815	2000	0	0	0	0	0	215	0.044	1686	0.128	0.01	868	-----	-----
OP#1	2038	7	12	0	0	0	202	0.044	1686	0.1337	0.009	868	-----	4.66
OP#2	2038	0	282	0	0	0	195	0.0445	1683	0.128	0.0095	917	-----	9.65
OP#3	1982	5	561	34	0	0	233	0.0403	1685	0.1281	0.0088	866	-----	10.02
1828	1498	0	0	0	0	1200	187	0.057	1632	0.164	0.012	719	-----	-----
OP#1	1396	5	10	0	0	0	197	0.0524	1632	0.1697	0.0112	720	-----	11.72
OP#2	1843	250	194	0	863	372	249	0.053	1632	0.1636	0.0098	720	-----	7.41
OP#3	1669	0	10	372	2168	0	206	0.0526	1632	0.1494	0.012	682	-----	22.97
1832	1484	0	0	515	0	0	208	0.047	1670	0.141	0.012	735	-----	-----
OP#1	1611	8	0	0	0	0	221	0.047	1681	0.1417	0.009	734	-----	11.98
OP#2	1530	29	1300	0	252	313	149	0.0469	1670	0.141	0.011	735	-----	0.23
OP#3	1616	27	0	55	1591	0	234	0.0471	1670	0.1408	0.0092	737	-----	0.83
1833	1899	0	928	0	0	1436	249	0.048	1691	0.128	0.01	796	-----	-----
OP#1	2043	500	0	0	0	0	250	0.0427	1707	0.1632	0.0118	888	TMnP-	303.79
OP#2	2315	0	1750	0	0	2115	250	0.0422	1686	0.1234	0.01	814	-----	22.85
OP#3	1985	0	1498	1133	1017	0	185	0.0434	1691	0.1281	0.01	794	-----	9.91
1834	1807	0	0	187	0	1004	212	0.054	1680	0.151	0.013	916	-----	-----
OP#1	1845	0	2000	0	0	0	229	0.0481	1675	0.1512	0.0124	899	C-----	28.5
OP#2	2251	0	0	0	623	0	250	0.0472	1677	0.1387	0.0094	916	-----	23.54
OP#3	1823	0	498	34	0	0	222	0.0476	1675	0.1513	0.0113	771	-----	32.73

1836	2138	0	0	915	0	33	247	0.054	1666	0.146	0.011	637	-----	-----
OP#1	2129	0	708	0	0	0	249	0.0504	1666	0.146	0.0092	636	-----	6.95
OP#2	2273	0	61	0	0	0	249	0.054	1661	0.1346	0.0082	676	-----	18.95
OP#3	2080	0	235	56	0	0	243	0.0524	1662	0.1461	0.0096	635	-----	7.72
1837	2350	0	0	951	104	0	190	0.042	1636	0.114	0.009	840	-----	-----
OP#1	2557	500	0	0	0	0	243	0.0463	1655	0.1439	0.0092	843	-T--P--	119.98
OP#2	2781	334	1415	0	528	806	236	0.0424	1636	0.1141	0.007	840	-----	1.11
OP#3	2632	24	0	899	2500	0	198	0.042	1640	0.1047	0.009	807	-----	18.62
1838	2358	0	0	0	0	0	189	0.037	1680	0.102	0.01	1224	-----	-----
OP#1	2476	493	250	0	0	0	182	0.04	1680	0.102	0.0092	1226	-----	8.37
OP#2	2696	0	0	0	667	8	243	0.037	1680	0.102	0.0078	1118	-----	8.78
OP#3	2214	0	2	753	0	0	164	0.0336	1680	0.0992	0.01	1063	-----	25.65
1839	2245	0	0	0	0	654	239	0.055	1683	0.161	0.013	633	-----	-----
OP#1	1965	55	14	0	0	0	223	0.0527	1683	0.1698	0.0119	633	-----	9.67
OP#2	2349	0	250	0	7	352	250	0.0524	1683	0.1611	0.012	633	-----	4.82
OP#3	1953	11	2000	346	81	0	215	0.0541	1683	0.161	0.0117	633	-----	1.65
1840	2079	0	0	0	0	1002	239	0.055	1683	0.153	0.012	607	-----	-----
OP#1	1958	0	39	0	0	0	234	0.051	1682	0.1727	0.0114	608	-----	20.97
OP#2	2332	0	1750	0	0	106	250	0.0505	1678	0.1582	0.0113	634	-----	21.17
OP#3	2175	0	1312	457	88	0	240	0.0515	1683	0.1531	0.0101	607	-----	6.53
1841	2133	0	0	514	0	0	210	0.058	1659	0.169	0.011	555	-----	-----
OP#1	1794	60	0	0	0	0	226	0.0561	1659	0.1924	0.0109	556	-----	17.49
OP#2	2153	48	827	0	130	493	248	0.0575	1659	0.1691	0.0106	555	-----	1.03
OP#3	1960	0	0	844	34	0	198	0.0576	1659	0.169	0.0107	556	-----	0.95
1844	2541	0	0	0	0	0	214	0.045	1663	0.126	0.011	833	-----	-----
OP#1	2662	1	0	0	0	0	202	0.0455	1673	0.1284	0.0096	833	-----	12.67
OP#2	2346	0	0	0	310	0	160	0.0449	1658	0.1223	0.011	823	-----	8.93
OP#3	2344	0	248	168	0	0	211	0.0444	1663	0.126	0.0109	835	-----	1.8
1845	1798	0	0	0	0	0	210	0.044	1667	0.134	0.011	817	-----	-----
OP#1	1914	15	0	0	0	0	216	0.044	1675	0.1341	0.0103	815	-----	8.03
OP#2	2190	0	1427	0	626	0	250	0.044	1665	0.134	0.0098	817	-----	1.78
OP#3	2002	0	8	103	1818	0	235	0.0439	1667	0.1302	0.011	794	-----	6.31
1846	2124	0	0	0	0	0	211	0.043	1680	0.129	0.009	1011	-----	-----
OP#1	2351	500	8	0	0	0	243	0.0424	1682	0.1282	0.009	921	-----	13.15
OP#2	2664	250	500	0	362	0	250	0.0391	1676	0.1212	0.009	1011	-----	19.08
OP#3	2334	0	1013	838	0	0	202	0.04	1680	0.1065	0.009	848	-----	41.44
1847	2386	0	0	0	0	0	211	0.046	1663	0.099	0.009	1040	-----	-----
OP#1	2471	291	1376	0	0	0	238	0.0411	1663	0.099	0.0086	1040	-----	10.67
OP#2	2547	0	0	0	46	0	250	0.0422	1658	0.0953	0.0063	952	-----	25.26
OP#3	2263	0	845	174	0	0	222	0.0395	1658	0.0986	0.009	892	-----	37.32
1848	1847	0	0	0	0	0	211	0.049	1664	0.138	0.01	900	-----	-----
OP#1	1921	458	653	0	0	0	241	0.0467	1664	0.138	0.0097	899	-----	4.77
OP#2	2163	63	0	0	623	0	250	0.0487	1664	0.1346	0.0094	891	-----	4.31
OP#3	1924	0	98	564	0	0	208	0.0465	1664	0.1278	0.01	758	-----	30
1851	2087	0	0	0	0	521	197	0.047	1639	0.129	0.01	884	-----	-----
OP#1	2341	500	0	0	0	0	244	0.0455	1652	0.1291	0.01	856	-----	19.11
OP#2	2525	161	63	0	1219	27	248	0.0448	1639	0.1292	0.0097	885	-----	4.97
OP#3	2293	1	2	1217	1249	0	182	0.0469	1639	0.1019	0.01	730	-----	39.45
1852	1785	0	0	0	0	194	217	0.05	1654	0.151	0.012	843	-----	-----
OP#1	1752	0	700	0	0	0	209	0.0477	1654	0.1511	0.0118	841	-----	5.37
OP#2	2070	125	0	0	613	0	250	0.0483	1654	0.1498	0.011	843	-----	4.13
OP#3	1723	0	0	958	0	0	166	0.0491	1650	0.1329	0.012	767	-----	26.45

1853	2160	0	0	0	0	0	202	0.042	1674	0.118	0.011	1104	-----	-----
OP#1	2327	423	1998	0	0	0	248	0.0419	1674	0.1181	0.0106	1102	-----	0.4
OP#2	2508	0	0	0	545	0	250	0.0415	1669	0.1136	0.008	994	-----	19.46
OP#3	2163	0	352	131	5	0	207	0.0383	1674	0.1179	0.011	955	-----	22.83
1854	3303	0	0	0	0	605	234	0.033	1677	0.091	0.012	1336	-----	-----
OP#1	3600	384	0	0	0	0	140	0.039	1683	0.0939	0.0097	1337	C-----	50.09
OP#2	3600	23	0	0	467	55	211	0.03	1676	0.0912	0.0084	1174	-----	22.53
OP#3	2979	0	1945	731	0	0	141	0.03	1674	0.091	0.0114	1183	-----	23.91
1858	3000	0	1481	0	0	0	213	0.038	1686	0.09	0.01	1320	-----	-----
OP#1	3339	469	0	0	0	0	160	0.0374	1686	0.0997	0.01	1325	-----	13.58
OP#2	3453	0	0	0	39	106	249	0.0312	1684	0.09	0.0086	1158	-----	31.86
OP#3	3004	0	1666	701	0	0	183	0.0298	1681	0.0834	0.01	1086	----O-	111.25
1859	2350	0	0	0	0	0	206	0.04	1691	0.152	0.014	1098	-----	-----
OP#1	2234	500	1697	0	0	0	243	0.0429	1691	0.1499	0.0139	1096	-----	9
OP#2	2664	0	0	0	1400	0	250	0.0372	1688	0.1461	0.0125	1092	-----	14.69
OP#3	2143	0	1001	245	626	0	195	0.0398	1691	0.1422	0.014	944	-----	21.1
1862	2319	0	2002	0	0	0	249	0.048	1668	0.125	0.009	982	-----	-----
OP#1	2381	370	1369	0	0	0	249	0.0434	1664	0.1174	0.009	980	-----	19.84
OP#2	2557	0	0	0	37	0	250	0.0434	1663	0.1045	0.0066	927	-----	36.5
OP#3	2251	0	1501	23	0	0	233	0.0415	1663	0.1084	0.009	849	-----	48.65
1863	1884	0	1996	0	0	1412	237	0.046	1653	0.123	0.009	922	-----	-----
OP#1	1723	500	0	0	0	0	250	0.0431	1666	0.1451	0.0095	881	---P--	95.8
OP#2	1985	125	0	0	618	1627	250	0.0443	1653	0.123	0.0084	920	-----	4.17
OP#3	1882	0	0	1051	1874	0	198	0.0438	1654	0.111	0.0089	766	-----	31.99
1864	1799	0	0	0	0	0	206	0.045	1669	0.134	0.011	923	-----	-----
OP#1	1696	125	0	0	0	0	195	0.0446	1669	0.1374	0.0107	924	-----	3.58
OP#2	2031	94	0	0	340	653	250	0.0449	1669	0.134	0.0104	922	-----	0.28
OP#3	1882	0	313	175	1127	0	239	0.0441	1669	0.1341	0.0109	772	-----	18.57
1865	1687	0	0	0	0	0	227	0.053	1669	0.116	0.008	922	-----	-----
OP#1	1489	438	22	0	0	0	209	0.0479	1656	0.1287	0.008	921	-----	24.91
OP#2	1870	4	500	0	655	575	250	0.0504	1660	0.116	0.0068	922	-----	4.9
OP#3	1410	78	2000	656	0	0	190	0.0466	1655	0.1076	0.008	758	-----	47.48
1866	2139	0	1994	0	0	0	232	0.047	1679	0.116	0.007	985	-----	-----
OP#1	2156	375	1374	0	0	0	247	0.0439	1674	0.1065	0.007	981	-----	19.86
OP#2	2205	0	0	0	0	0	227	0.047	1674	0.097	0.0055	1018	-----	24.75
OP#3	2036	0	0	0	0	0	248	0.0406	1668	0.1139	0.0064	831	-T-----	101.82
1871	1864	0	0	0	0	0	181	0.043	1661	0.102	0.005	891	-----	-----
OP#1	2016	407	0	0	0	0	232	0.0442	1676	0.102	0.0048	893	-----	18
OP#2	1921	281	1752	0	37	0	195	0.0478	1661	0.1012	0.005	891	-----	11.99
OP#3	1762	6	0	854	76	0	193	0.043	1661	0.099	0.005	814	-----	11.85
1876	2098	0	0	0	0	701	233	0.052	1667	0.129	0.007	624	-----	-----
OP#1	2114	438	0	0	0	0	250	0.0469	1672	0.1348	0.007	783	-----	45.32
OP#2	2156	0	1750	0	0	0	249	0.0524	1662	0.1274	0.0069	679	-----	15.81
OP#3	2036	0	0	643	0	0	231	0.0504	1663	0.128	0.007	623	-----	8.06
1879	1900	0	0	0	0	0	147	0.044	1679	0.135	0.01	1071	-----	-----
OP#1	2012	344	0	0	0	0	177	0.0446	1682	0.1351	0.0098	1072	-----	4.13
OP#2	2227	3	0	0	1549	0	229	0.044	1677	0.1333	0.009	1071	-----	3.09
OP#3	1706	0	1005	851	0	0	154	0.0433	1675	0.1197	0.01	909	-----	32.15
1883	1706	0	0	0	0	0	149	0.039	1684	0.095	0.007	1355	-----	-----
OP#1	2273	500	0	0	0	0	216	0.0338	1700	0.0948	0.008	1193	---P--	188.23
OP#2	2300	0	0	0	821	1001	250	0.0359	1681	0.0949	0.0069	1193	-----	23.35
OP#3	2036	0	1947	879	626	0	195	0.0325	1684	0.0734	0.007	987	----O-	220.29



1886	1575	0	0	965	1373	0	229	0.057	1636	0.121	0.005	427	-----	-----
OP#1	1317	167	0	0	0	0	250	0.0517	1652	0.1513	0.0068	588	---P--	449.56
OP#2	1415	0	2000	0	0	1498	243	0.0611	1634	0.1211	0.0046	468	-----	19.33
OP#3	1405	65	0	1141	626	0	215	0.059	1636	0.121	0.005	429	-----	3.89
1889	1905	0	0	0	0	1378	152	0.051	1699	0.171	0.018	989	-----	-----
OP#1	1965	42	57	0	0	0	140	0.0507	1699	0.1745	0.0145	989	-----	2.73
OP#2	2515	163	18	0	995	653	245	0.0463	1699	0.1713	0.0128	988	-----	9.45
OP#3	1709	0	2000	526	274	0	140	0.0446	1699	0.177	0.0149	963	-----	19.25
1890	1798	0	0	578	0	0	233	0.06	1659	0.154	0.007	459	-----	-----
OP#1	1452	0	0	0	0	0	250	0.0552	1658	0.1622	0.007	460	-----	15.02
OP#2	1647	0	1730	0	0	0	236	0.0622	1654	0.1514	0.007	536	-----	27.12
OP#3	1603	0	749	302	0	0	250	0.0584	1654	0.1541	0.0066	483	-----	13.25
1891	1810	0	0	916	2095	0	143	0.041	1634	0.106	0.012	990	-----	-----
OP#1	2036	464	0	0	0	0	160	0.0477	1649	0.1292	0.0089	1120	C-----	99.29
OP#2	2109	500	874	0	899	1279	143	0.041	1634	0.106	0.0069	991	-----	0.4
OP#3	1625	127	2000	435	2422	0	140	0.0409	1634	0.106	0.0106	989	-----	0.37
1894	1925	0	0	594	284	0	229	0.045	1671	0.138	0.01	720	-----	-----
OP#1	1990	67	0	0	0	0	223	0.0485	1678	0.138	0.0082	719	-----	14.44
OP#2	1999	0	1750	0	0	0	195	0.0499	1670	0.1379	0.0099	730	-----	13.2
OP#3	1999	49	0	370	218	0	228	0.0463	1671	0.1381	0.0086	718	-----	3.22
1896	2096	0	2003	0	0	551	224	0.051	1662	0.15	0.008	584	-----	-----
OP#1	2036	496	0	0	0	0	250	0.0498	1676	0.1562	0.0088	746	---P--	147.02
OP#2	2104	1	1711	0	0	1267	248	0.0557	1658	0.1366	0.008	584	-----	21.97
OP#3	2065	68	0	691	1210	0	230	0.0509	1662	0.1421	0.008	585	-----	7.17
1897	1670	0	0	0	0	0	150	0.044	1638	0.063	0.007	1141	-----	-----
OP#1	1799	16	0	0	0	0	140	0.0422	1640	0.0654	0.0051	1141	-----	9.7
OP#2	2231	97	1022	0	1405	59	250	0.0401	1638	0.0631	0.0011	1140	-----	9.09
OP#3	1596	4	1625	382	932	0	174	0.0381	1637	0.063	0.007	1006	-----	27.18
1898	2228	0	2003	0	0	528	228	0.051	1667	0.126	0.007	607	-----	-----
OP#1	1943	126	0	0	0	0	250	0.05	1679	0.1321	0.007	608	-----	18.53
OP#2	2021	4	1900	0	0	250	243	0.0562	1664	0.1254	0.007	607	-----	13.83
OP#3	1906	63	839	323	626	0	242	0.0509	1666	0.1261	0.0069	605	-----	1.7
1900	2592	0	2001	0	0	2518	216	0.046	1610	0.092	0.006	541	-----	-----
OP#1	2877	147	0	0	0	0	250	0.0456	1664	0.1224	0.0077	703	-T-P--	793.62
OP#2	2366	184	1937	0	29	2628	155	0.0469	1610	0.0919	0.0059	541	-----	1.99
OP#3	2542	345	63	1037	2500	0	221	0.046	1621	0.0919	0.006	541	-----	11.15
1903	1725	0	0	0	0	0	150	0.044	1706	0.118	0.009	1364	-----	-----
OP#1	2222	500	0	0	0	0	179	0.0404	1721	0.1068	0.0099	1203	---P--	140.09
OP#2	2515	114	4	0	2065	35	250	0.0396	1706	0.1181	0.0083	1306	-----	14.34
OP#3	1687	0	970	1065	78	0	142	0.0377	1705	0.1121	0.009	1007	----O-	189.62
1905	2369	0	2001	907	0	0	228	0.06	1647	0.123	0.004	364	-----	-----
OP#1	2349	5	0	0	0	0	250	0.0519	1660	0.156	0.0072	526	CMnP	980.21
OP#2	2302	0	1783	0	0	1001	250	0.0597	1634	0.1239	0.0038	525	-T----	137.48
OP#3	2349	16	1496	958	0	0	250	0.0568	1642	0.123	0.0037	420	-----	25.97
1907	1955	0	0	0	0	0	200	0.042	1708	0.144	0.014	1069	-----	-----
OP#1	2178	494	2000	0	0	0	249	0.0447	1708	0.1322	0.0111	1069	-----	14.72
OP#2	2317	0	0	0	584	0	195	0.042	1705	0.1245	0.01	1067	-----	16.66
OP#3	1845	0	31	0	2	0	181	0.0363	1705	0.1439	0.0114	1070	-----	16.17
1828	1498	0	0	0	0	1200	187	0.057	1632	0.164	0.012	719	-----	-----
OP#1	1396	5	10	0	0	0	197	0.0524	1632	0.1697	0.0112	720	-----	11.72
OP#2	1843	250	194	0	863	372	249	0.053	1632	0.1636	0.0098	720	-----	7.41
OP#3	1669	0	10	372	2168	0	206	0.0526	1632	0.1494	0.012	682	-----	22.97

1909	1547	0	0	995	815	124	229	0.06	1678	0.144	0.008	406	-----	-----
OP#1	1332	154	0	0	0	0	250	0.0538	1693	0.1837	0.0102	543	CMn	447.47
OP#2	1635	51	2000	0	0	1994	250	0.0603	1673	0.1415	0.008	521	-----	35.55
OP#3	1586	19	2000	844	1139	0	246	0.059	1678	0.1441	0.0058	407	-----	1.92
1910	1601	0	0	0	0	258	164	0.06	1687	0.188	0.013	761	-----	-----
OP#1	1476	0	244	0	0	0	180	0.0547	1684	0.1883	0.013	762	-----	11.89
OP#2	1928	282	125	0	396	117	248	0.057	1687	0.1881	0.0118	761	-----	5.04
OP#3	1352	0	2000	99	0	0	188	0.0536	1687	0.1899	0.013	745	-----	13.91
1912	1806	0	0	0	0	584	166	0.058	1673	0.171	0.015	628	-----	-----
OP#1	1723	1	686	0	0	0	221	0.056	1672	0.1717	0.0112	629	-----	4.95
OP#2	1862	78	6	0	188	0	195	0.0578	1673	0.1705	0.0122	628	-----	0.79
OP#3	1772	0	585	185	132	0	219	0.0553	1673	0.171	0.0108	629	-----	4.87
1913	1735	0	0	0	0	999	225	0.055	1652	0.137	0.007	445	-----	-----
OP#1	1508	250	0	0	0	0	250	0.0525	1669	0.1772	0.0095	603	TMnP-	543.15
OP#2	1647	0	1906	0	0	2002	234	0.0591	1647	0.1335	0.0065	477	-----	22.29
OP#3	1647	144	0	1006	1249	0	228	0.0554	1653	0.1371	0.0059	443	-----	1.81
1914	1798	0	0	0	0	1026	174	0.06	1677	0.201	0.018	714	-----	-----
OP#1	1413	33	504	0	0	0	197	0.056	1677	0.2099	0.0149	713	-----	11.28
OP#2	1980	235	516	0	838	344	250	0.0559	1677	0.2011	0.0131	714	-----	6.96
OP#3	1405	11	999	356	938	0	175	0.0552	1677	0.2013	0.0145	713	-----	8.69
1915	1986	0	0	0	0	0	184	0.053	1675	0.187	0.016	968	-----	-----
OP#1	2004	497	2000	0	0	0	248	0.05	1671	0.1795	0.0136	969	-----	13.96
OP#2	2349	0	0	0	1083	0	250	0.05	1670	0.1688	0.0106	884	-----	28.56
OP#3	1726	0	0	0	0	0	172	0.0467	1673	0.1869	0.0151	916	-----	19.02
1917	2239	499	0	0	0	1135	174	0.053	1670	0.131	0.01	657	-----	-----
OP#1	1831	141	4	0	0	0	223	0.053	1676	0.1596	0.0088	656	-----	27.57
OP#2	2200	31	1840	0	37	626	233	0.0531	1670	0.1309	0.0067	658	-----	0.6
OP#3	2041	3	1500	450	1559	0	234	0.0495	1670	0.1311	0.0063	656	-----	7
1918	1711	0	0	0	0	0	223	0.05	1691	0.2	0.012	495	-----	-----
OP#1	1936	0	0	0	0	0	250	0.0495	1691	0.206	0.014	572	---P--	185.67
OP#2	2258	0	1279	0	0	2002	250	0.0499	1671	0.1692	0.012	657	-T----	218.87
OP#3	2195	93	0	687	0	0	250	0.0502	1686	0.1871	0.0114	539	-----	20.71
1919	1849	498	0	0	0	1192	168	0.046	1689	0.13	0.01	1037	-----	-----
OP#1	1968	500	0	0	0	0	229	0.0456	1704	0.1496	0.01	910	-----	43.69
OP#2	2310	63	250	0	1373	997	250	0.0457	1689	0.1302	0.0082	1036	-----	0.99
OP#3	1638	2	999	1081	604	0	140	0.0432	1689	0.13	0.0098	914	-----	17.86
1923	2476	496	0	0	0	1248	177	0.05	1671	0.158	0.01	761	-----	-----
OP#1	2129	500	0	0	0	0	250	0.0513	1686	0.1855	0.0109	719	---P--	131.85
OP#2	2400	110	1892	0	762	512	222	0.0499	1671	0.158	0.0092	762	-----	0.25
OP#3	1933	2	1500	738	1327	0	178	0.0493	1671	0.1581	0.01	760	-----	1.55
1924	1854	0	0	0	0	558	213	0.058	1629	0.152	0.007	388	-----	-----
OP#1	1413	2	0	0	0	0	250	0.0523	1630	0.1548	0.008	518	C---P--	197.21
OP#2	1667	0	1666	0	0	500	250	0.0577	1624	0.1446	0.007	471	-----	31.64
OP#3	1706	125	23	783	24	0	249	0.0578	1629	0.1332	0.007	386	-----	13.18
1926	1806	0	0	849	0	0	221	0.05	1675	0.181	0.011	450	-----	-----
OP#1	1706	15	0	0	0	0	250	0.0506	1690	0.1858	0.0116	556	---P--	93.34
OP#2	1867	0	2000	0	0	1126	248	0.0564	1670	0.1695	0.011	545	-----	45.25
OP#3	1628	437	0	352	0	0	250	0.0502	1675	0.169	0.0098	450	-----	7.2
1927	2421	0	0	0	0	131	173	0.046	1645	0.103	0.005	755	-----	-----
OP#1	2535	180	2	0	0	0	237	0.046	1654	0.1083	0.005	757	-----	14.42
OP#2	2273	0	506	0	0	0	187	0.049	1641	0.103	0.0049	784	-----	14.76
OP#3	2332	0	0	701	0	0	218	0.0451	1641	0.0997	0.005	739	-----	11.33

1929	2076	0	0	0	0	482	174	0.05	1643	0.138	0.008	773	-----	-----
OP#1	2063	294	8	0	0	0	235	0.0477	1643	0.1532	0.008	773	-----	15.73
OP#2	2122	0	874	0	0	0	221	0.05	1642	0.1379	0.0072	773	-----	0.95
OP#3	2114	0	29	394	0	0	238	0.0475	1642	0.138	0.008	687	-----	17.09
1931	1963	0	0	0	0	112	173	0.041	1677	0.152	0.013	1057	-----	-----
OP#1	2141	500	2000	0	0	0	249	0.0454	1677	0.1483	0.012	1059	-----	13.26
OP#2	2332	63	49	0	743	0	195	0.041	1677	0.1413	0.0108	1058	-----	7.26
OP#3	1892	0	0	271	0	0	167	0.0386	1677	0.151	0.013	1032	-----	9.67
1932	1874	0	0	0	0	282	178	0.042	1647	0.109	0.008	982	-----	-----
OP#1	2117	500	1674	0	0	0	250	0.0472	1652	0.1039	0.0061	982	-----	21.81
OP#2	2038	123	528	0	618	0	140	0.0438	1647	0.0853	0.0051	982	-----	26.19
OP#3	1823	0	0	0	418	0	195	0.042	1647	0.1072	0.008	939	-----	6.23
1939	2648	0	0	0	0	0	200	0.042	1666	0.13	0.01	953	-----	-----
OP#1	2476	445	203	0	0	0	233	0.0429	1666	0.1299	0.0089	952	-----	2.23
OP#2	2349	0	0	0	134	0	188	0.042	1661	0.1284	0.0099	931	-----	8.51
OP#3	2312	0	0	290	0	0	221	0.0402	1663	0.1289	0.01	868	-----	17.7
1943	2472	0	0	0	0	0	220	0.038	1669	0.124	0.008	976	-----	-----
OP#1	2420	500	272	0	0	0	240	0.0417	1669	0.124	0.0079	976	-----	9.79
OP#2	2508	2	1044	0	0	0	204	0.0381	1667	0.1131	0.008	995	-----	12.7
OP#3	2344	64	63	405	0	0	234	0.0379	1665	0.1181	0.008	835	-----	24.91
1944	2056	0	0	0	0	0	217	0.037	1696	0.159	0.013	966	-----	-----
OP#1	2207	484	123	0	0	0	238	0.0416	1696	0.159	0.0125	964	-----	12.52
OP#2	2508	15	999	0	12	0	229	0.037	1696	0.152	0.0127	970	-----	4.94
OP#3	2117	0	8	257	469	0	208	0.037	1696	0.1587	0.013	959	-----	1.84
1945	2826	0	0	0	0	640	199	0.034	1689	0.144	0.013	1226	-----	-----
OP#1	2950	500	1443	0	0	0	221	0.0393	1699	0.1309	0.0128	1225	-----	34.61
OP#2	2899	0	0	0	626	0	195	0.0338	1688	0.1323	0.0119	1129	-----	17.43
OP#3	2508	0	47	349	196	0	181	0.0332	1689	0.1403	0.013	1078	-----	17.32
1948	1822	0	0	0	0	709	215	0.044	1688	0.173	0.014	778	-----	-----
OP#1	2026	37	0	0	0	0	226	0.0443	1694	0.173	0.0129	779	-----	6.74
OP#2	2224	0	1369	0	0	125	233	0.044	1685	0.1729	0.013	779	-----	3.09
OP#3	1946	62	907	18	494	0	234	0.0439	1688	0.1728	0.0129	782	-----	0.83
1949	1737	0	0	0	0	336	174	0.056	1667	0.166	0.012	802	-----	-----
OP#1	1652	37	1509	0	0	0	223	0.052	1667	0.1668	0.012	803	-----	7.74
OP#2	1982	86	0	0	584	0	250	0.0557	1667	0.1583	0.0087	802	-----	5.2
OP#3	1440	3	999	101	0	0	186	0.0506	1665	0.1661	0.0117	800	-----	11.86
1953	2084	0	0	0	0	17	182	0.043	1648	0.166	0.017	816	-----	-----
OP#1	1936	17	1877	0	0	0	250	0.0479	1648	0.1615	0.0125	816	-----	14.12
OP#2	2048	118	295	0	78	0	168	0.043	1648	0.156	0.0118	816	-----	6.19
OP#3	1823	187	0	5	37	0	205	0.0434	1648	0.1563	0.0132	818	-----	7.04
1955	2086	0	0	0	0	0	174	0.043	1650	0.16	0.011	817	-----	-----
OP#1	1990	102	0	0	0	0	220	0.0448	1654	0.1601	0.0104	817	-----	8.32
OP#2	2038	116	999	0	7	0	195	0.0435	1650	0.158	0.0109	817	-----	2.37
OP#3	1985	63	63	428	547	0	211	0.043	1650	0.1446	0.011	803	-----	11.53
1957	1990	0	0	0	0	0	187	0.04	1667	0.146	0.014	1135	-----	-----
OP#1	2261	415	498	0	0	0	206	0.0399	1667	0.146	0.0116	1135	-----	0.48
OP#2	2349	0	4	0	357	121	219	0.0379	1667	0.1462	0.011	1057	-----	12.26
OP#3	1916	0	446	301	0	0	166	0.0356	1665	0.1461	0.014	1081	-----	17.51
1961	1763	496	0	0	0	696	180	0.041	1671	0.154	0.014	1048	-----	-----
OP#1	1980	391	0	0	0	0	206	0.0412	1686	0.1631	0.0139	1046	-----	21.42
OP#2	2231	390	1155	0	621	426	244	0.041	1671	0.154	0.0118	1048	-----	0.19
OP#3	1608	0	282	768	745	0	156	0.0407	1671	0.1539	0.014	959	-----	9.32



1963	2278	491	0	0	0	554	176	0.039	1650	0.127	0.014	1006	-----	-----
OP#1	2266	315	2	0	0	0	197	0.0436	1665	0.1487	0.0117	1006	-----	43.86
OP#2	2478	372	436	0	645	907	213	0.039	1650	0.127	0.009	1006	-----	0.09
OP#3	1865	100	567	760	1249	0	140	0.039	1651	0.127	0.0128	991	-----	2.5
1968	1753	0	0	0	0	393	224	0.046	1685	0.175	0.012	977	-----	-----
OP#1	1933	492	1054	0	0	0	229	0.0479	1685	0.1729	0.012	978	-----	5.42
OP#2	2036	0	0	0	1210	0	180	0.046	1681	0.165	0.0112	977	-----	9.51
OP#3	1682	0	502	70	0	0	193	0.0448	1685	0.1732	0.012	887	-----	12.99
1970	1961	0	0	0	0	0	199	0.052	1680	0.162	0.012	939	-----	-----
OP#1	2041	0	616	0	0	0	238	0.0446	1675	0.1636	0.012	782	C-----	77.09
OP#2	2295	0	0	0	32	0	250	0.0452	1675	0.1508	0.0106	914	-----	27.68
OP#3	1960	0	248	0	0	0	236	0.0448	1671	0.162	0.0119	789	CT----	95.64
1971	1715	0	0	0	0	0	209	0.052	1691	0.193	0.016	655	-----	-----
OP#1	1550	3	405	0	0	0	250	0.0476	1691	0.1929	0.0148	655	-----	8.69
OP#2	1887	0	1298	0	0	98	250	0.0493	1686	0.202	0.0157	655	-----	14.56
OP#3	1728	0	0	526	0	0	224	0.0505	1691	0.1923	0.0138	655	-----	3.62
1974	1420	0	0	0	0	0	225	0.051	1679	0.147	0.01	932	-----	-----
OP#1	1647	355	2	0	0	0	195	0.0484	1679	0.1481	0.01	932	-----	6.07
OP#2	2014	0	156	0	1153	59	249	0.0506	1679	0.1469	0.008	932	-----	0.82
OP#3	1410	13	999	465	10	0	176	0.0466	1679	0.147	0.01	843	-----	18.82
1978	1909	0	0	0	0	397	200	0.053	1690	0.213	0.017	921	-----	-----
OP#1	1958	313	1488	0	0	0	218	0.0519	1688	0.213	0.017	923	-----	4.01
OP#2	2466	0	0	0	1562	0	250	0.0487	1688	0.1995	0.0142	915	-----	16.8
OP#3	1779	0	375	0	547	0	178	0.0487	1690	0.2129	0.017	865	-----	14.21
1979	2126	0	0	0	0	0	204	0.044	1698	0.208	0.014	501	-----	-----
OP#1	2078	0	0	0	0	0	250	0.0484	1699	0.2078	0.0159	594	---P--	164.13
OP#2	2349	0	762	0	0	2440	250	0.0485	1673	0.1776	0.014	642	-T-----	279.74
OP#3	2293	312	0	688	0	0	250	0.0447	1693	0.183	0.0126	549	-----	28.16
1982	1717	0	0	0	0	0	197	0.056	1671	0.201	0.015	672	-----	-----
OP#1	1567	0	1421	0	0	0	249	0.0526	1666	0.2013	0.0134	671	-----	10.94
OP#2	1872	0	12	0	78	0	245	0.056	1671	0.1875	0.0115	672	-----	7.24
OP#3	1726	0	0	0	32	0	236	0.0525	1671	0.1898	0.0119	658	-----	14.06
1983	1724	0	0	0	0	1	207	0.057	1697	0.202	0.013	398	-----	-----
OP#1	1723	0	0	0	0	0	250	0.0529	1696	0.2088	0.0141	505	---P--	126.06
OP#2	2036	0	1265	0	0	809	250	0.0562	1682	0.1948	0.013	532	-T-----	148.31
OP#3	2034	0	0	911	0	0	250	0.0563	1692	0.1922	0.0095	441	-----	21.82
1984	1831	0	0	293	0	0	201	0.046	1681	0.155	0.008	737	-----	-----
OP#1	2117	500	0	0	0	0	250	0.0459	1690	0.1526	0.0082	825	---P--	47.36
OP#2	2078	0	1490	0	0	0	236	0.0521	1677	0.1471	0.008	738	-----	22.75
OP#3	2038	0	0	175	540	0	247	0.0453	1681	0.1491	0.0076	731	-----	6.26
1987	2297	0	0	0	0	0	215	0.06	1672	0.176	0.008	452	-----	-----
OP#1	1938	2	0	0	0	0	250	0.0548	1673	0.1931	0.0096	469	---P--	225.22
OP#2	2249	0	1937	0	0	110	250	0.0578	1667	0.1653	0.008	604	-----	48.23
OP#3	2187	0	0	765	0	0	250	0.0553	1667	0.1684	0.0064	476	-----	22.56
1989	3418	0	0	0	0	2196	168	0.043	1628	0.087	0.004	868	-----	-----
OP#1	3600	500	0	0	0	0	250	0.0445	1659	0.1295	0.008	853	-TMnP	1383.6
OP#2	3522	20	133	0	306	1748	248	0.043	1628	0.0871	0.0029	868	-----	0.34
OP#3	3500	0	532	1369	2493	0	225	0.0409	1628	0.087	0.004	707	-----	23.43
1991	2046	0	0	0	0	1543	211	0.047	1695	0.177	0.011	715	-----	-----
OP#1	2114	500	0	0	0	0	250	0.0469	1710	0.1909	0.013	805	---P--	220.16
OP#2	2429	65	2000	0	78	1486	250	0.0466	1691	0.155	0.011	774	-----	25.25
OP#3	2102	2	31	701	1239	0	219	0.0467	1695	0.177	0.0109	708	-----	1.81

1993	2502	0	0	0	0	0	187	0.044	1635	0.117	0.008	957	-----	-----
OP#1	2632	395	111	0	0	0	223	0.0432	1635	0.1321	0.0079	956	-----	14.95
OP#2	2779	0	0	0	313	0	250	0.0415	1635	0.117	0.006	941	-----	7.57
OP#3	2625	0	0	887	0	0	209	0.0416	1633	0.1055	0.008	797	-----	33.69
1997	1695	0	0	0	0	0	202	0.039	1685	0.165	0.012	1077	-----	-----
OP#1	2021	497	127	0	0	0	197	0.0441	1691	0.1651	0.0117	1076	-----	18.76
OP#2	2195	117	749	0	1259	0	183	0.039	1685	0.1562	0.0115	1079	-----	5.6
OP#3	1682	52	125	794	171	0	140	0.039	1685	0.1481	0.012	1004	-----	17.08
1998	2298	0	0	677	0	0	217	0.057	1672	0.186	0.012	416	-----	-----
OP#1	1882	0	0	0	0	0	250	0.0544	1673	0.2148	0.0128	474	---P--	101.99
OP#2	2224	0	2000	0	0	94	250	0.0558	1667	0.1883	0.012	513	-----	31.76
OP#3	2036	125	387	530	0	0	249	0.0577	1667	0.1859	0.0104	421	-----	7.45
2005	1796	0	0	736	0	0	217	0.053	1659	0.163	0.007	420	-----	-----
OP#1	1645	4	0	0	0	0	250	0.0491	1670	0.1829	0.0107	582	---P--	595.27
OP#2	1875	0	1877	0	0	2002	250	0.0533	1648	0.1326	0.007	581	-T-----	132.5
OP#3	1801	181	0	943	0	0	247	0.0539	1658	0.1435	0.007	417	-----	15.15
2006	2348	0	0	0	0	0	207	0.035	1689	0.095	0.007	1371	-----	-----
OP#1	2544	476	186	0	0	0	209	0.0342	1684	0.0949	0.007	1224	-----	18.63
OP#2	2664	0	0	0	0	0	250	0.0334	1684	0.0738	0.0043	1276	-----	38.73
OP#3	2195	0	1517	0	0	0	227	0.0292	1677	0.0822	0.007	1077	CT-O-	251.02
2007	1723	0	0	795	0	0	218	0.05	1670	0.154	0.008	588	-----	-----
OP#1	1679	226	0	0	0	0	250	0.0447	1680	0.1666	0.0105	749	---P--	372.18
OP#2	1980	0	1734	0	0	1376	250	0.0462	1665	0.1327	0.008	737	-----	51.71
OP#3	1818	8	8	854	450	0	238	0.05	1670	0.1443	0.008	583	-----	7.49
2008	1803	0	0	610	0	0	205	0.037	1669	0.12	0.007	1076	-----	-----
OP#1	1970	500	0	0	0	0	250	0.0415	1684	0.1335	0.0071	913	---P--	71.82
OP#2	2043	377	1672	0	628	0	168	0.0372	1669	0.1141	0.0069	1076	-----	5.47
OP#3	1789	25	0	714	1249	0	182	0.037	1669	0.1052	0.007	955	-----	23.6
2009	1763	0	0	912	1590	0	217	0.052	1675	0.153	0.008	503	-----	-----
OP#1	1594	308	0	0	0	0	250	0.0507	1690	0.1826	0.011	659	---P--	442.08
OP#2	1882	0	1891	0	0	2002	250	0.0552	1670	0.1403	0.0078	584	-----	35.55
OP#3	1804	78	0	906	1503	0	240	0.0525	1675	0.1515	0.0067	501	-----	2.41
2011	2273	0	0	825	1010	0	219	0.044	1677	0.163	0.011	734	-----	-----
OP#1	2427	500	0	0	0	0	250	0.0441	1692	0.1827	0.013	860	---P--	226.73
OP#2	2561	0	248	0	0	2002	249	0.0444	1672	0.148	0.011	806	-----	24.79
OP#3	2329	66	10	1161	626	0	194	0.0441	1676	0.1538	0.011	731	-----	7.04
2015	2324	0	0	846	211	0	202	0.035	1680	0.159	0.016	1224	-----	-----
OP#1	2754	500	0	0	0	0	140	0.0422	1695	0.1429	0.0129	1317	C-----	107.4
OP#2	2754	86	8	0	2209	0	174	0.035	1680	0.1507	0.0123	1226	-----	5.53
OP#3	2195	0	2	1	2295	0	157	0.0349	1680	0.1589	0.0152	1153	-----	6.19
2016	1855	0	0	0	0	0	199	0.046	1661	0.151	0.011	942	-----	-----
OP#1	1755	440	622	0	0	0	233	0.0456	1661	0.151	0.0109	941	-----	0.91
OP#2	2148	0	0	0	1249	0	250	0.0445	1661	0.1408	0.009	934	-----	10.88
OP#3	1726	0	0	701	716	0	177	0.0451	1661	0.1277	0.0109	841	-----	28.24
2017	2703	0	0	954	547	0	224	0.04	1682	0.138	0.008	941	-----	-----
OP#1	2779	500	0	0	0	0	250	0.0443	1697	0.1607	0.0121	856	---P--	557.9
OP#2	3143	1	1118	0	0	2264	250	0.0383	1677	0.0951	0.008	952	-----	41.42
OP#3	2899	0	0	1358	1105	0	209	0.0383	1682	0.1173	0.008	792	-----	34.98
2019	2553	0	0	935	580	0	229	0.046	1662	0.156	0.007	671	-----	-----
OP#1	2578	500	0	0	0	0	250	0.047	1677	0.1559	0.009	802	---P--	325.93
OP#2	2664	78	2000	0	0	485	250	0.049	1659	0.1326	0.007	717	-----	31.18
OP#3	2586	0	0	801	1251	0	234	0.046	1661	0.1331	0.0069	670	-----	15.38

2023	2361	0	0	0	0	0	226	0.044	1662	0.146	0.007	560	-----	-----
OP#1	2244	93	0	0	0	0	250	0.0436	1662	0.1331	0.0082	722	---P--	210.29
OP#2	2192	0	1761	0	0	207	249	0.0495	1643	0.1278	0.007	718	-T-----	213.82
OP#3	2454	0	0	788	0	0	249	0.0421	1657	0.1073	0.0063	702	-----	61.01
2025	1962	0	0	0	0	0	226	0.05	1660	0.169	0.009	529	-----	-----
OP#1	1750	0	0	0	0	0	250	0.0462	1660	0.169	0.0098	637	---P--	113.18
OP#2	1928	0	1439	0	0	0	250	0.0501	1653	0.155	0.009	690	-T-----	61.78
OP#3	1938	2	0	606	0	0	250	0.0512	1655	0.1439	0.0082	567	-----	29.69
2026	1811	0	0	115	0	0	225	0.051	1674	0.189	0.011	466	-----	-----
OP#1	1838	0	0	0	0	0	250	0.051	1687	0.1961	0.0123	543	---P--	147.66
OP#2	2031	0	1500	0	0	1126	250	0.0556	1669	0.1722	0.011	577	-----	46.86
OP#3	1814	336	0	413	0	0	250	0.0511	1674	0.1753	0.01	466	-----	7.74
2028	1736	0	0	0	0	0	230	0.06	1694	0.205	0.014	493	-----	-----
OP#1	1493	0	0	0	0	0	250	0.0523	1689	0.2061	0.0134	517	C-----	63.8
OP#2	1892	0	874	0	0	8	250	0.0544	1689	0.1994	0.014	589	-----	36.37
OP#3	1682	0	0	302	0	0	250	0.0576	1689	0.2028	0.0119	497	-----	10.89
2029	2562	0	0	0	0	0	229	0.055	1664	0.156	0.008	523	-----	-----
OP#1	2234	0	0	0	0	0	250	0.0497	1659	0.1715	0.0099	568	---P--	270.75
OP#2	2505	0	1480	0	0	676	247	0.0491	1648	0.1416	0.008	669	-T-----	171.84
OP#3	2571	0	0	784	0	0	250	0.0488	1659	0.1426	0.0079	585	-----	36.57
2030	2779	0	0	0	0	0	220	0.04	1661	0.126	0.008	1068	-----	-----
OP#1	2820	500	248	0	0	0	212	0.0423	1661	0.1258	0.0078	1068	-----	5.88
OP#2	2916	0	0	0	271	0	238	0.04	1661	0.1013	0.0057	1067	-----	20.21
OP#3	2762	0	2	1	626	0	249	0.036	1659	0.1132	0.008	907	-----	36.9
2037	1891	0	0	214	0	0	238	0.048	1663	0.196	0.014	519	-----	-----
OP#1	1584	0	0	0	0	0	250	0.0502	1658	0.1935	0.011	559	-----	18.45
OP#2	1647	0	498	0	0	0	188	0.0508	1658	0.1923	0.0139	617	-----	31.32
OP#3	1811	344	0	327	0	0	250	0.0482	1658	0.1563	0.0101	522	-----	26.3
2043	1995	0	0	0	0	0	232	0.048	1658	0.157	0.008	602	-----	-----
OP#1	1801	171	0	0	0	0	250	0.043	1659	0.1575	0.0096	764	---P--	239.59
OP#2	2036	0	1752	0	0	892	250	0.0442	1648	0.1358	0.008	758	-T-----	109.57
OP#3	2036	0	55	935	0	0	242	0.0481	1655	0.1317	0.008	598	-----	20.21
2045	2048	0	0	0	0	0	230	0.037	1674	0.145	0.011	737	-----	-----
OP#1	2117	0	0	0	0	0	250	0.0402	1678	0.1526	0.011	757	-----	20.36
OP#2	2310	0	1562	0	0	532	236	0.0383	1665	0.1443	0.011	899	-T-----	73.57
OP#3	2170	250	0	350	0	0	250	0.037	1670	0.1371	0.0107	747	-----	10.43
2048	1702	0	0	354	0	0	221	0.044	1676	0.174	0.011	728	-----	-----
OP#1	1696	500	0	0	0	0	250	0.0436	1678	0.1741	0.012	871	---P--	116.28
OP#2	2009	4	999	0	0	1251	250	0.044	1671	0.1514	0.011	789	-----	26.31
OP#3	1875	49	0	701	780	0	223	0.0441	1676	0.1487	0.0108	725	-----	15.25
2052	1644	0	0	961	544	0	222	0.052	1666	0.17	0.009	524	-----	-----
OP#1	1489	180	0	0	0	0	250	0.0478	1681	0.1923	0.0129	671	---P--	491.9
OP#2	1977	0	1760	0	0	3003	247	0.0463	1661	0.131	0.0089	685	-----	71.61
OP#3	1892	0	149	896	2309	0	248	0.052	1666	0.157	0.009	523	-----	8.17
2057	1500	0	0	0	0	690	203	0.049	1671	0.172	0.011	794	-----	-----
OP#1	1315	309	0	0	0	0	224	0.049	1671	0.1857	0.0109	793	-----	8.48
OP#2	1608	245	999	0	293	274	212	0.0497	1671	0.1719	0.011	794	-----	1.56
OP#3	1344	0	375	677	469	0	174	0.0483	1671	0.1588	0.011	795	-----	10.1
2058	1786	0	0	0	0	1359	228	0.047	1635	0.139	0.006	467	-----	-----
OP#1	1537	250	0	0	0	0	250	0.0512	1659	0.1817	0.0105	629	TMnP-	1037.1
OP#2	1765	4	2000	0	0	2753	226	0.0538	1634	0.1227	0.006	470	-----	28.01
OP#3	1787	414	0	770	2500	0	243	0.0476	1643	0.1179	0.006	467	-----	24.61

2059	2053	0	0	0	0	0	200	0.045	1675	0.135	0.01	1023	-----	-----
OP#1	1970	463	59	0	0	0	216	0.0421	1675	0.138	0.0099	1022	-----	8.74
OP#2	2131	0	0	0	623	0	250	0.045	1674	0.134	0.0092	1010	-----	3.32
OP#3	1882	0	0	350	0	0	217	0.0407	1674	0.1301	0.01	861	-----	29.67
2064	2250	0	0	0	0	1973	215	0.033	1660	0.134	0.01	802	-----	-----
OP#1	3097	500	0	0	0	0	250	0.0389	1714	0.136	0.0134	963	CT--P-	841.51
OP#2	2857	266	2000	0	156	2510	196	0.0367	1660	0.0982	0.01	801	-----	38.01
OP#3	2613	390	0	881	2500	0	206	0.0329	1675	0.1028	0.01	805	-----	39.88
2065	1697	0	0	0	0	0	202	0.054	1668	0.165	0.011	647	-----	-----
OP#1	1559	0	0	0	0	0	221	0.0512	1668	0.1728	0.0108	648	-----	10.12
OP#2	1870	54	626	0	115	51	242	0.0539	1668	0.1649	0.0101	647	-----	0.24
OP#3	1726	0	192	1	1134	0	244	0.052	1668	0.1651	0.0104	645	-----	3.98
2067	1537	0	0	0	0	0	214	0.041	1675	0.16	0.013	890	-----	-----
OP#1	1772	500	637	0	0	0	249	0.0463	1683	0.1538	0.0086	891	-----	24.52
OP#2	1726	226	1750	0	156	0	140	0.044	1675	0.1426	0.0098	891	-----	18.36
OP#3	1452	125	0	10	315	0	195	0.0417	1675	0.154	0.0102	895	-----	5.9
2069	2423	0	0	0	0	0	224	0.038	1698	0.099	0.005	890	-----	-----
OP#1	2710	414	0	0	0	0	250	0.0364	1698	0.0928	0.005	981	-----	20.95
OP#2	2505	0	610	0	0	0	245	0.0421	1679	0.0998	0.0046	1052	-T-----	190.55
OP#3	2491	0	751	230	0	0	250	0.0316	1685	0.0933	0.005	950	-T-----	121.23
2072	1900	0	0	0	0	1397	194	0.051	1625	0.134	0.007	825	-----	-----
OP#1	1958	500	0	0	0	0	250	0.0464	1640	0.1523	0.0077	815	---P--	137.41
OP#2	2085	0	500	0	1095	946	247	0.05	1625	0.1341	0.0052	824	-----	2.27
OP#3	1990	0	0	1070	1571	0	202	0.049	1625	0.1201	0.007	665	-----	33.73
2075	2558	0	0	948	0	2337	213	0.045	1641	0.112	0.008	782	-----	-----
OP#1	2974	498	0	0	0	0	250	0.0406	1689	0.1508	0.0104	929	-TMnP	825.64
OP#2	2798	161	1398	0	15	2983	250	0.044	1641	0.1121	0.006	782	-----	2.42
OP#3	2637	37	2000	1400	2500	0	195	0.0436	1646	0.112	0.0074	717	-----	16.65
2078	2371	0	0	882	0	0	230	0.047	1694	0.142	0.009	621	-----	-----
OP#1	2537	155	0	0	0	0	250	0.0417	1700	0.1606	0.0106	782	---P--	230.12
OP#2	2344	0	890	0	0	1501	236	0.0472	1667	0.1443	0.0089	782	-T-----	277.51
OP#3	2586	0	282	699	0	0	250	0.0405	1687	0.1419	0.008	737	-T-----	56.73
2079	1709	0	0	311	0	0	197	0.055	1679	0.212	0.016	788	-----	-----
OP#1	2041	48	2000	0	0	0	250	0.0506	1678	0.1899	0.0143	787	-----	19.31
OP#2	2349	0	0	0	350	0	249	0.0512	1677	0.1771	0.0113	788	-----	25.44
OP#3	1892	0	0	0	0	0	206	0.0493	1676	0.1939	0.0137	787	-----	22.43
2081	2041	0	0	763	0	0	215	0.044	1691	0.139	0.008	753	-----	-----
OP#1	2505	375	0	0	0	0	250	0.0393	1705	0.1408	0.0095	910	---P--	233.55
OP#2	2349	0	4	0	0	1533	250	0.0457	1677	0.1312	0.008	913	-T-----	132.17
OP#3	2329	0	557	594	0	0	247	0.041	1688	0.1391	0.0077	751	-----	10.47
2083	1999	0	0	0	0	1631	195	0.059	1637	0.163	0.01	669	-----	-----
OP#1	1972	500	0	0	0	0	250	0.0504	1652	0.194	0.0126	736	CMnP	376.89
OP#2	2173	125	500	0	467	1756	250	0.0533	1635	0.163	0.01	668	-----	12.24
OP#3	2068	0	0	1367	1229	0	201	0.0554	1637	0.1595	0.01	520	-----	30.82
2084	1604	0	0	511	0	0	209	0.06	1672	0.147	0.008	872	-----	-----
OP#1	1535	500	0	0	0	0	250	0.0504	1667	0.1634	0.0084	736	C--P--	172.68
OP#2	1916	0	0	0	626	215	250	0.0531	1671	0.1472	0.0074	809	-----	20.21
OP#3	1489	0	1949	597	0	0	195	0.051	1668	0.1352	0.008	708	C-----	91.35
2085	2328	0	0	0	0	0	222	0.048	1648	0.126	0.004	577	-----	-----
OP#1	2349	250	0	0	0	0	250	0.0461	1658	0.1226	0.0049	731	---P--	256.71
OP#2	2087	2	936	0	0	16	224	0.0549	1641	0.1224	0.004	740	-T-----	74.2
OP#3	2219	0	0	573	0	0	250	0.0476	1643	0.1182	0.0039	633	-----	21.71



2086	2102	0	0	0	0	325	199	0.055	1624	0.115	0.006	818	-----	-----
OP#1	2019	500	0	0	0	0	250	0.0475	1629	0.145	0.0061	794	C---P--	107.69
OP#2	2163	81	282	0	149	966	250	0.0514	1624	0.115	0.0035	818	-----	6.68
OP#3	2060	0	250	963	105	0	212	0.0486	1624	0.1149	0.0059	661	-----	31.72
2088	1689	0	0	0	0	0	212	0.05	1677	0.203	0.013	809	-----	-----
OP#1	1804	498	498	0	0	0	235	0.0523	1677	0.1889	0.0127	809	-----	11.6
OP#2	2038	187	968	0	398	16	196	0.0512	1677	0.172	0.0125	808	-----	17.81
OP#3	1726	0	0	0	623	0	209	0.0483	1678	0.1882	0.013	795	-----	12.96
2089	1668	0	0	916	0	47	213	0.053	1685	0.2	0.01	507	-----	-----
OP#1	1721	6	0	0	0	0	250	0.0489	1694	0.2126	0.0143	587	---P--	473.13
OP#2	2036	0	1095	0	0	3484	250	0.0507	1663	0.1507	0.01	646	-T-----	244.07
OP#3	2082	0	59	1015	435	0	247	0.0522	1685	0.182	0.01	505	-----	11.1
2090	2070	0	0	958	0	0	212	0.054	1681	0.214	0.012	465	-----	-----
OP#1	1804	0	0	0	0	0	250	0.0535	1682	0.2152	0.0139	493	---P--	168.64
OP#2	2349	0	1109	0	0	1466	250	0.0505	1674	0.178	0.012	613	-T-----	82.9
OP#3	2048	156	0	519	0	0	250	0.0544	1681	0.2006	0.0117	465	-----	6.99
2092	1748	0	0	519	0	0	209	0.048	1676	0.172	0.01	814	-----	-----
OP#1	2273	499	0	0	0	0	250	0.0454	1689	0.1719	0.0112	834	---P--	136.01
OP#2	2395	87	2000	0	156	16	250	0.0484	1676	0.1561	0.01	815	-----	10.42
OP#3	2114	0	0	389	313	0	241	0.0476	1676	0.1681	0.01	679	-----	19.9
2093	1899	0	0	966	0	1003	218	0.047	1673	0.194	0.01	401	-----	-----
OP#1	1657	110	0	0	0	0	250	0.0523	1688	0.2173	0.014	557	---P--	481.26
OP#2	2036	0	1689	0	0	3152	248	0.0538	1662	0.1575	0.01	563	-T-----	145.86
OP#3	1735	500	250	643	540	0	248	0.0497	1673	0.1778	0.01	402	-----	14.41
2095	1758	0	0	940	887	0	214	0.049	1661	0.194	0.01	504	-----	-----
OP#1	1625	0	0	0	0	0	250	0.0478	1676	0.1954	0.0119	605	---P--	232.08
OP#2	1723	0	14	0	0	2264	250	0.0548	1654	0.1696	0.01	659	-T-----	79.24
OP#3	1611	344	125	513	156	0	243	0.049	1661	0.1709	0.01	503	-----	12.13
2096	1998	0	0	0	0	0	210	0.05	1676	0.195	0.015	897	-----	-----
OP#1	1980	267	929	0	0	0	228	0.0474	1676	0.195	0.0141	896	-----	5.36
OP#2	2295	63	0	0	701	0	250	0.0471	1676	0.1942	0.0131	895	-----	6.55
OP#3	1843	0	1048	11	154	0	205	0.0473	1676	0.1951	0.015	821	-----	13.93
2097	2295	0	0	0	0	518	212	0.038	1682	0.18	0.01	664	-----	-----
OP#1	2505	124	0	0	0	0	250	0.0395	1696	0.1645	0.0128	815	---P--	329.24
OP#2	2505	0	1750	0	0	2264	250	0.0414	1660	0.1359	0.01	826	-T-----	253.56
OP#3	2466	250	0	821	0	0	250	0.038	1678	0.144	0.01	670	-----	24.97
2098	2089	0	0	0	0	1003	201	0.056	1633	0.181	0.008	622	-----	-----
OP#1	1919	408	0	0	0	0	250	0.0507	1633	0.1888	0.0101	696	---P--	293.64
OP#2	2205	0	1453	0	20	798	250	0.052	1630	0.1578	0.008	622	-----	23.04
OP#3	2246	0	0	1315	364	0	209	0.0513	1633	0.1413	0.008	576	-----	37.73
2102	2260	0	0	0	0	562	209	0.046	1661	0.174	0.011	843	-----	-----
OP#1	2297	500	0	0	0	0	250	0.0456	1676	0.1859	0.0112	830	---P--	39.29
OP#2	2319	125	172	0	279	1067	218	0.0461	1661	0.1732	0.011	844	-----	1.61
OP#3	2202	1	0	788	1090	0	202	0.046	1661	0.171	0.011	751	-----	12.76
2103	2052	0	0	0	0	2006	196	0.049	1641	0.141	0.008	793	-----	-----
OP#1	2324	500	0	0	0	0	250	0.0454	1663	0.1746	0.0112	834	TMnP-	547.39
OP#2	2508	281	186	0	37	2002	250	0.0454	1641	0.1409	0.0078	794	-----	7.44
OP#3	2459	0	0	1226	2500	0	219	0.0473	1642	0.1363	0.008	631	-----	27.66
2104	2217	0	0	0	0	1298	215	0.054	1658	0.187	0.009	417	-----	-----
OP#1	1684	66	0	0	0	0	250	0.0531	1673	0.2171	0.0121	526	---P--	404.78
OP#2	2009	0	1906	0	0	2252	249	0.0558	1653	0.1708	0.009	541	-----	46.65
OP#3	1892	240	0	706	1092	0	249	0.0541	1658	0.1851	0.009	416	-----	1.5

2106	2565	0	0	0	0	0	210	0.04	1676	0.117	0.008	1169	-----	-----
OP#1	2662	500	0	0	0	0	223	0.0371	1676	0.1244	0.008	1103	-----	19.41
OP#2	2740	0	0	0	2	0	241	0.0353	1676	0.1169	0.0076	1166	-----	12.15
OP#3	2525	0	1699	300	0	0	235	0.033	1671	0.107	0.008	954	----O-	95.15
2108	2038	0	0	0	0	0	209	0.049	1672	0.22	0.017	858	-----	-----
OP#1	2068	123	2000	0	0	0	248	0.0487	1672	0.2069	0.0155	860	-----	7.27
OP#2	2349	0	0	0	848	0	250	0.0486	1668	0.198	0.013	858	-----	14.77
OP#3	1882	0	0	11	0	0	188	0.0476	1670	0.2071	0.0164	858	-----	10.98
2109	2268	0	0	626	0	0	234	0.048	1684	0.158	0.011	674	-----	-----
OP#1	2249	304	0	0	0	0	250	0.0418	1699	0.1951	0.0133	834	C-MnP--	344.36
OP#2	2349	0	565	0	0	1865	250	0.0434	1677	0.1594	0.011	832	-T-----	65.53
OP#3	2173	0	1470	1035	0	0	216	0.0467	1683	0.158	0.0102	673	-----	3.71
2113	1913	0	0	943	2521	0	212	0.043	1669	0.144	0.008	680	-----	-----
OP#1	1858	500	0	0	0	0	250	0.045	1697	0.197	0.0133	842	-TMnP--	1052.26
OP#2	2156	0	2000	0	0	3058	243	0.0448	1669	0.1273	0.008	685	-----	16.79
OP#3	1884	266	2	1165	2500	0	205	0.043	1673	0.1338	0.008	646	-----	17.43
2114	1900	0	0	0	0	0	204	0.042	1658	0.153	0.009	835	-----	-----
OP#1	2202	500	0	0	0	0	250	0.0386	1663	0.153	0.0091	970	-----	36.38
OP#2	2156	0	1492	0	0	0	243	0.042	1653	0.1498	0.0089	867	-----	10.91
OP#3	2224	0	0	536	0	0	243	0.041	1658	0.1338	0.009	768	-----	23.21
2116	1886	0	0	0	0	2	203	0.045	1660	0.182	0.012	860	-----	-----
OP#1	2046	244	29	0	0	0	223	0.0448	1660	0.1853	0.012	860	-----	2.31
OP#2	2224	110	61	0	149	12	239	0.045	1660	0.182	0.0117	860	-----	0.05
OP#3	2117	0	0	438	310	0	221	0.0448	1660	0.1682	0.0119	769	-----	18.5
2120	2438	0	0	0	0	0	219	0.037	1685	0.132	0.009	1092	-----	-----
OP#1	2674	489	12	0	0	0	249	0.0324	1685	0.1323	0.009	1093	-----	12.76
OP#2	2725	0	0	0	0	0	250	0.0307	1680	0.125	0.0088	1229	-----	40.38
OP#3	2505	15	1992	167	0	0	250	0.0309	1676	0.1103	0.009	965	-T-----	93.35
2125	1800	0	0	0	0	0	209	0.04	1661	0.164	0.008	1227	-----	-----
OP#1	2334	500	0	0	0	0	245	0.0347	1674	0.1379	0.0093	1065	---P--	221.87
OP#2	2341	43	8	0	1244	250	250	0.0364	1656	0.141	0.008	1175	-----	32.16
OP#3	2195	0	1752	931	1256	0	196	0.0335	1657	0.0949	0.008	962	----O-	169.25
2126	1900	0	0	0	0	14	197	0.045	1673	0.217	0.02	889	-----	-----
OP#1	2078	500	143	0	0	0	237	0.046	1673	0.2064	0.0139	889	-----	7.11
OP#2	2307	1	33	0	799	0	241	0.0451	1673	0.2036	0.0147	888	-----	6.45
OP#3	1941	0	0	0	623	0	196	0.045	1673	0.2035	0.0168	885	-----	7.07
2128	2288	0	0	0	0	0	198	0.048	1671	0.186	0.011	1048	-----	-----
OP#1	2583	500	0	0	0	0	249	0.043	1677	0.174	0.0114	886	---P--	78.24
OP#2	2742	0	250	0	1012	8	250	0.0418	1668	0.1629	0.011	1048	-----	28.32
OP#3	2339	0	2000	1033	0	0	170	0.0408	1665	0.1343	0.011	889	C-----	92.26
2129	2141	0	0	0	0	865	209	0.045	1656	0.191	0.008	465	-----	-----
OP#1	1928	0	0	0	0	0	250	0.0468	1666	0.1987	0.0129	626	---P--	663.2
OP#2	2163	0	1881	0	0	2847	250	0.0482	1635	0.1442	0.008	623	-T-----	245.35
OP#3	2280	312	0	1325	83	0	247	0.0451	1656	0.139	0.0073	467	-----	28.09
2130	1894	0	0	904	0	0	200	0.047	1686	0.147	0.01	1012	-----	-----
OP#1	1862	499	0	0	0	0	250	0.0417	1701	0.1753	0.0133	907	---P--	381.21
OP#2	2209	171	500	0	134	2502	250	0.0411	1681	0.1256	0.01	1011	-----	32
OP#3	1882	0	1791	989	1415	0	196	0.0396	1685	0.1295	0.01	850	C-----	66.08
2131	2608	0	0	689	0	0	208	0.037	1680	0.127	0.007	585	-----	-----
OP#1	2383	0	0	0	0	0	250	0.0403	1675	0.1531	0.0096	755	---P--	454.73
OP#2	2146	0	1863	0	0	2002	210	0.0439	1636	0.1188	0.0066	748	-T-----	487.34
OP#3	2644	3	0	959	0	0	250	0.038	1667	0.1125	0.0064	747	-T-----	138.7

2132	1827	0	0	0	0	0	194	0.05	1671	0.198	0.017	900	-----	-----
OP#1	1838	260	262	0	0	0	205	0.0479	1671	0.198	0.0145	899	-----	4.4
OP#2	2290	0	250	0	1305	78	250	0.0451	1671	0.1982	0.0133	899	-----	10.15
OP#3	1581	0	326	526	220	0	144	0.0477	1671	0.1979	0.0167	901	-----	4.79
2133	1772	0	0	0	0	0	206	0.05	1666	0.176	0.01	426	-----	-----
OP#1	1569	0	0	0	0	0	250	0.0486	1668	0.2074	0.013	589	--MnP--	370.47
OP#2	1723	0	1746	0	0	1959	250	0.0546	1645	0.1694	0.01	555	-T-----	225.43
OP#3	2041	125	0	1343	0	0	250	0.0512	1662	0.1493	0.0071	426	-----	21.65
2136	2249	0	0	0	0	0	195	0.054	1662	0.206	0.015	719	-----	-----
OP#1	2075	87	1120	0	0	0	248	0.0502	1661	0.2031	0.015	719	-----	9.55
OP#2	2297	0	0	0	27	0	250	0.0521	1662	0.1972	0.0139	718	-----	8.15
OP#3	2036	0	884	34	0	0	223	0.0507	1660	0.1975	0.015	717	-----	12.29
2139	2033	0	0	0	0	597	202	0.058	1657	0.225	0.014	355	-----	-----
OP#1	1608	0	0	0	0	0	250	0.058	1656	0.2257	0.0124	404	-----	15.64
OP#2	1850	0	1894	0	0	0	223	0.0604	1653	0.2236	0.0139	354	-----	9.18
OP#3	1662	436	0	55	0	0	250	0.058	1653	0.2116	0.0126	355	-----	10
2140	1780	0	0	0	0	911	197	0.041	1670	0.183	0.011	799	-----	-----
OP#1	2158	500	0	0	0	0	250	0.0451	1685	0.1837	0.0111	841	----P--	41.07
OP#2	2253	250	2000	0	164	4	230	0.0464	1670	0.1816	0.011	800	-----	13.97
OP#3	2073	125	0	179	1894	0	228	0.0413	1670	0.17	0.011	797	-----	8.15
2141	1737	0	0	0	0	596	198	0.059	1666	0.243	0.016	355	-----	-----
OP#1	1225	0	0	0	0	0	250	0.0567	1661	0.2357	0.0138	430	-----	32.98
OP#2	1533	0	1793	0	0	0	238	0.0612	1661	0.2428	0.0158	355	-----	8.77
OP#3	1449	344	0	196	0	0	250	0.059	1662	0.2202	0.0134	355	-----	13.1
2142	1775	0	0	0	0	772	194	0.054	1666	0.201	0.015	830	-----	-----
OP#1	1567	31	1503	0	0	0	223	0.0506	1666	0.2031	0.0147	830	-----	7.4
OP#2	1958	34	0	0	1092	59	249	0.0515	1666	0.201	0.0124	830	-----	4.63
OP#3	1567	0	0	79	938	0	188	0.049	1666	0.198	0.015	826	-----	11.5
2144	1602	0	0	0	0	920	207	0.055	1660	0.23	0.021	708	-----	-----
OP#1	1364	0	1875	0	0	0	250	0.0531	1656	0.2246	0.0164	706	-----	9.73
OP#2	1723	0	0	0	1210	0	226	0.0534	1656	0.2188	0.0148	708	-----	11.56
OP#3	1335	60	0	10	103	0	188	0.055	1660	0.217	0.0171	709	-----	5.84
2145	1887	0	0	0	0	109	200	0.057	1668	0.247	0.016	387	-----	-----
OP#1	1550	0	0	0	0	0	250	0.0555	1663	0.2195	0.0125	453	-----	35.68
OP#2	1647	0	217	0	0	0	218	0.0603	1663	0.2349	0.0159	450	-----	32.36
OP#3	2060	109	0	881	0	0	250	0.0573	1666	0.1882	0.0099	386	-----	26.23
2147	1891	0	0	0	0	546	198	0.049	1656	0.207	0.011	383	-----	-----
OP#1	1723	0	0	0	0	0	250	0.0522	1658	0.2098	0.0127	519	----P--	203.23
OP#2	2036	0	1503	0	0	1627	247	0.0538	1644	0.179	0.011	540	-T-----	146.12
OP#3	1972	500	0	827	0	0	250	0.0492	1651	0.1621	0.0094	383	-----	26.87
2149	1526	0	0	0	0	0	198	0.06	1666	0.238	0.011	365	-----	-----
OP#1	1347	0	0	0	0	0	250	0.0534	1661	0.2138	0.0123	495	C---P--	199.37
OP#2	1645	0	678	0	0	2072	250	0.0584	1648	0.1837	0.011	517	-T-----	210.46
OP#3	1916	0	0	1162	0	0	250	0.0589	1661	0.1791	0.0087	364	-----	31.64
2150	1763	0	0	512	0	798	184	0.047	1657	0.167	0.009	762	-----	-----
OP#1	1909	500	0	0	0	0	250	0.0472	1672	0.1834	0.0116	799	----P--	315.2
OP#2	2192	376	1773	0	20	1345	247	0.0481	1653	0.1519	0.009	762	-----	15.92
OP#3	1950	0	1501	1392	1329	0	172	0.0468	1657	0.1315	0.009	735	-----	25.24
2152	1575	0	0	0	0	0	197	0.05	1669	0.208	0.015	781	-----	-----
OP#1	1467	172	1425	0	0	0	250	0.05	1669	0.1866	0.0144	781	-----	10.36
OP#2	1716	147	22	0	557	0	207	0.0499	1669	0.1925	0.0148	782	-----	7.72
OP#3	1388	29	0	527	0	0	167	0.05	1669	0.1815	0.0149	793	-----	14.7

2153	1396	0	0	0	0	0	183	0.054	1660	0.161	0.007	480	-----	-----
OP#1	1503	199	0	0	0	0	250	0.0496	1675	0.1924	0.0106	642	--MnP--	593.54
OP#2	1723	0	1376	0	0	2370	250	0.0556	1655	0.1426	0.007	635	-----	55.09
OP#3	1730	6	0	879	1105	0	245	0.0548	1660	0.1609	0.007	482	-----	2.03
2156	2049	0	0	0	0	1941	181	0.046	1634	0.173	0.011	482	-----	-----
OP#1	2038	375	0	0	0	0	250	0.0529	1650	0.1955	0.0113	640	CT--P--	153.79
OP#2	2087	66	1994	0	15	1498	194	0.0527	1633	0.1664	0.0109	497	-----	22.46
OP#3	1990	500	0	216	1777	0	243	0.0489	1634	0.1639	0.0109	483	-----	11.72
2157	2642	0	0	0	0	0	219	0.036	1673	0.117	0.009	1111	-----	-----
OP#1	2625	488	1032	0	0	0	250	0.0369	1673	0.1114	0.0086	1111	-----	7.42
OP#2	2566	0	0	0	0	0	218	0.036	1668	0.1023	0.0076	1140	-----	19.98
OP#3	2469	0	0	0	0	0	246	0.0323	1668	0.1109	0.0089	977	-----	32.36
2159	2184	0	0	0	0	0	195	0.04	1678	0.165	0.011	937	-----	-----
OP#1	2596	500	129	0	0	0	228	0.0452	1692	0.152	0.0088	936	-----	34.78
OP#2	2434	73	2000	0	315	0	140	0.0404	1678	0.1283	0.0092	937	-----	23.44
OP#3	2058	84	0	4	166	0	195	0.0401	1678	0.157	0.0106	939	-----	5.2
2160	2424	0	0	0	0	475	190	0.042	1670	0.154	0.011	484	-----	-----
OP#1	2522	207	0	0	0	0	250	0.0496	1685	0.1819	0.0122	646	C---P--	247.18
OP#2	2576	1	2000	0	0	809	218	0.0492	1665	0.1459	0.011	647	-----	71.15
OP#3	2256	500	0	413	0	0	250	0.0463	1665	0.1506	0.0096	484	-----	17.51
2161	1798	0	0	0	0	0	198	0.042	1657	0.127	0.007	503	-----	-----
OP#1	1880	15	0	0	0	0	250	0.0451	1671	0.1444	0.0082	664	---P--	237.07
OP#2	1718	0	2000	0	0	1157	185	0.0489	1645	0.1193	0.007	666	-T-----	137.12
OP#3	1726	250	0	524	0	0	250	0.0482	1652	0.1251	0.0063	533	-----	26.97
2162	1751	0	0	0	0	0	193	0.045	1651	0.145	0.007	480	-----	-----
OP#1	1723	11	0	0	0	0	250	0.0462	1658	0.1551	0.0087	641	---P--	297.11
OP#2	1723	0	1546	0	0	1451	229	0.0519	1636	0.1281	0.007	626	-T-----	175.56
OP#3	1882	125	0	885	0	0	250	0.0511	1646	0.1239	0.0064	486	-----	34.27
2169	1146	0	0	0	0	3969	173	0.047	1667	0.174	0.013	748	-----	-----
OP#1	1388	220	0	0	0	0	237	0.0471	1671	0.1937	0.0128	748	-----	15.61
OP#2	1823	70	1498	0	183	985	247	0.047	1667	0.1738	0.0122	748	-----	0.18
OP#3	1679	0	514	47	2356	0	236	0.0467	1667	0.1739	0.013	750	-----	1.69
2173	2448	0	0	0	0	1012	191	0.042	1617	0.091	0.005	647	-----	-----
OP#1	2459	344	0	0	0	0	250	0.0439	1635	0.1209	0.0062	809	-T--P--	346.59
OP#2	2324	0	2000	0	0	1216	181	0.042	1614	0.091	0.0045	725	-----	15.55
OP#3	2586	65	4	799	1874	0	249	0.0437	1618	0.089	0.005	648	-----	7.63
2174	1986	0	0	0	0	0	189	0.037	1670	0.128	0.012	1115	-----	-----
OP#1	2271	330	0	0	0	0	185	0.0407	1677	0.1281	0.0096	1114	-----	17.04
OP#2	2341	125	242	0	794	231	197	0.037	1670	0.1277	0.0094	1114	-----	0.42
OP#3	1887	0	1011	328	469	0	166	0.0367	1670	0.128	0.012	1058	-----	6.15
2175	2055	0	0	0	0	0	210	0.058	1670	0.186	0.011	439	-----	-----
OP#1	1814	0	0	0	0	0	250	0.0527	1667	0.1995	0.0118	509	---P--	107.03
OP#2	2192	0	1478	0	0	575	250	0.0531	1662	0.1702	0.011	597	-T-----	86.4
OP#3	2131	0	0	723	0	0	250	0.0569	1665	0.1751	0.0097	455	-----	17
2176	2518	0	0	0	0	0	181	0.043	1630	0.105	0.007	945	-----	-----
OP#1	2429	488	6	0	0	0	239	0.0418	1635	0.1182	0.007	944	-----	20.5
OP#2	2566	17	180	0	586	106	250	0.0413	1630	0.105	0.0052	945	-----	4.1
OP#3	2381	0	0	1221	78	0	191	0.0423	1630	0.0856	0.007	787	-----	38.96
2177	2383	0	0	0	0	0	205	0.044	1680	0.202	0.017	645	-----	-----
OP#1	2256	78	311	0	0	0	250	0.0491	1680	0.1865	0.0125	643	-----	19.47
OP#2	2351	0	498	0	0	0	195	0.0455	1676	0.183	0.0147	687	-----	23.84
OP#3	2354	250	0	88	78	0	250	0.0449	1680	0.1695	0.0123	645	-----	18.28



2178	2181	0	0	0	0	0	182	0.04	1674	0.098	0.007	1135	-----	-----
OP#1	2273	500	0	0	0	0	250	0.0346	1681	0.1189	0.0081	1049	----P--	205.41
OP#2	2349	0	61	0	15	1372	250	0.0349	1668	0.0984	0.007	1078	-T-----	39.8
OP#3	2212	12	2000	1126	310	0	195	0.0336	1669	0.0726	0.007	934	-----O-	100.03
2182	2278	0	0	0	0	501	202	0.035	1697	0.134	0.009	1059	-----	-----
OP#1	2791	500	0	0	0	0	250	0.0377	1712	0.1357	0.0102	987	----P--	164
OP#2	2977	102	1990	0	5	172	250	0.0343	1695	0.1204	0.009	1062	-----	13.91
OP#3	2566	0	0	833	0	0	214	0.0349	1697	0.1299	0.009	906	-----	17.83
2186	2294	0	0	0	0	0	206	0.05	1673	0.168	0.01	477	-----	-----
OP#1	2349	0	0	0	0	0	250	0.0473	1677	0.1713	0.0101	615	-----	46.56
OP#2	2332	0	1627	0	0	0	246	0.052	1659	0.1645	0.0097	639	-T-----	140.33
OP#3	2346	0	0	301	0	0	250	0.0493	1668	0.1646	0.0099	638	-----	45.15
2194	2420	0	0	543	0	3001	185	0.04	1656	0.12	0.016	1026	-----	-----
OP#1	2395	500	0	0	0	0	140	0.0488	1673	0.15	0.0125	1186	CT-----	191.24
OP#2	2850	328	436	0	1449	2002	217	0.04	1656	0.1195	0.0074	1027	-----	0.59
OP#3	2273	63	1629	1137	2500	0	141	0.04	1663	0.12	0.0103	937	-----	15.89
2201	1742	0	0	0	993	2002	209	0.043	1650	0.139	0.014	952	-----	-----
OP#1	1721	16	0	0	0	0	160	0.048	1665	0.1599	0.0123	950	-----	41.78
OP#2	2271	63	1251	0	1882	1482	243	0.043	1650	0.1389	0.0084	949	-----	0.62
OP#3	1413	250	1846	367	2422	0	142	0.0424	1650	0.1389	0.0139	920	-----	4.82
2210	1427	0	0	899	0	0	215	0.051	1670	0.158	0.01	880	-----	-----
OP#1	1550	500	0	0	0	0	250	0.0469	1685	0.1749	0.0107	805	----P--	114.01
OP#2	1801	16	544	0	1339	997	240	0.0501	1670	0.1588	0.0097	879	-----	2.44
OP#3	1435	0	127	985	1014	0	177	0.0501	1670	0.1538	0.01	719	-----	23.78
2213	1950	0	0	0	0	0	224	0.04	1689	0.171	0.018	1003	-----	-----
OP#1	2447	457	0	0	0	0	223	0.0413	1697	0.171	0.0139	1003	-----	11.3
OP#2	2608	39	4	0	608	246	250	0.04	1689	0.1717	0.0147	1002	-----	0.57
OP#3	2019	0	495	521	0	0	156	0.04	1688	0.171	0.0165	1003	-----	0.9
2215	1874	0	0	0	0	0	216	0.048	1653	0.127	0.007	825	-----	-----
OP#1	2178	499	0	0	0	0	250	0.0427	1657	0.1379	0.0094	888	----P--	381.54
OP#2	2420	0	1955	0	0	680	250	0.042	1648	0.1034	0.007	826	-----	35.97
OP#3	2346	0	563	917	332	0	243	0.0443	1653	0.1009	0.007	663	-----	48.22
2217	2243	0	0	330	0	0	221	0.04	1686	0.149	0.012	918	-----	-----
OP#1	2503	389	0	0	0	0	226	0.0437	1701	0.159	0.0117	920	-----	31.09
OP#2	2503	250	999	0	20	375	189	0.0402	1686	0.1398	0.012	918	-----	6.65
OP#3	2273	0	237	142	1557	0	212	0.04	1686	0.1491	0.0118	912	-----	0.79
2218	2149	0	0	416	0	0	220	0.037	1700	0.119	0.009	1099	-----	-----
OP#1	2798	500	0	0	0	0	250	0.0368	1715	0.1257	0.0091	1005	-----	36.94
OP#2	2830	96	160	0	37	133	250	0.0365	1700	0.119	0.0087	1099	-----	1.37
OP#3	2337	0	547	744	0	0	192	0.0357	1695	0.1191	0.009	957	-----	21.81
2219	1723	0	0	528	0	0	230	0.041	1689	0.143	0.009	841	-----	-----
OP#1	2190	500	0	0	0	0	250	0.0428	1704	0.1661	0.0114	887	----P--	307.38
OP#2	2322	0	645	0	0	2002	238	0.0438	1684	0.1197	0.009	890	-----	33.74
OP#3	2195	0	0	701	1249	0	222	0.0407	1689	0.1363	0.0089	805	-----	10.14
2220	1675	0	0	406	0	0	223	0.044	1686	0.156	0.012	918	-----	-----
OP#1	1840	377	0	0	0	0	223	0.0441	1687	0.1661	0.0119	919	-----	8.17
OP#2	2156	0	407	0	645	121	250	0.044	1686	0.1561	0.0116	917	-----	0.23
OP#3	1723	4	88	747	5	0	176	0.044	1685	0.1471	0.012	854	-----	13.83
2223	2322	0	0	0	0	805	225	0.056	1667	0.173	0.014	566	-----	-----
OP#1	2012	0	0	0	0	0	243	0.0512	1667	0.1924	0.0114	564	-----	20.07
OP#2	2146	0	373	0	0	20	250	0.0554	1662	0.1829	0.0117	588	-----	15.68
OP#3	2139	3	248	378	0	0	240	0.0543	1665	0.173	0.0109	568	-----	5.61

2229	3582	0	0	0	0	484	222	0.033	1666	0.103	0.008	1276	-----	-----
OP#1	3600	500	0	0	0	0	193	0.0422	1670	0.1196	0.0086	1115	C--P--	257.85
OP#2	3580	0	0	0	626	43	194	0.0326	1664	0.103	0.008	1162	-----	12.64
OP#3	3331	0	1892	1243	98	0	155	0.03	1662	0.0793	0.008	1083	----O-	75.62
2285	2223	0	0	1401	0	1165	215	0.045	1627	0.093	0.007	949	-----	-----
OP#1	2820	500	0	0	0	0	250	0.0398	1668	0.1227	0.0088	946	-T--P--	591.36
OP#2	2740	0	0	0	1056	2565	248	0.0413	1627	0.093	0.0043	937	-----	9.62
OP#3	2593	0	1439	1243	2500	0	197	0.0413	1635	0.0892	0.007	786	-----	38.23
2287	1843	0	0	919	0	728	223	0.037	1661	0.109	0.008	1129	-----	-----
OP#1	2117	500	0	0	0	0	250	0.0384	1681	0.1388	0.0088	974	-T--P--	210.74
OP#2	2349	0	1001	0	1386	997	248	0.037	1661	0.1097	0.0066	1128	-----	0.77
OP#3	1972	0	1394	1269	1520	0	157	0.0363	1660	0.0842	0.008	968	-----	40.15
2291	1603	0	0	267	0	480	228	0.047	1641	0.115	0.006	859	-----	-----
OP#1	1726	500	0	0	0	0	250	0.0452	1656	0.1423	0.0061	839	---P--	64.42
OP#2	1611	173	72	0	132	1709	168	0.047	1641	0.115	0.0057	859	-----	0.16
OP#3	1567	37	63	1223	386	0	173	0.0471	1641	0.1139	0.006	736	-----	15.48
2301	1710	0	0	0	0	518	219	0.05	1660	0.172	0.011	718	-----	-----
OP#1	1836	375	256	0	0	0	250	0.0504	1660	0.169	0.0103	718	-----	2.64
OP#2	2195	280	248	0	88	0	245	0.0502	1660	0.1704	0.0103	718	-----	1.31
OP#3	1875	15	0	821	442	0	184	0.05	1660	0.1569	0.011	718	-----	8.85
2307	1575	0	0	0	0	0	220	0.042	1688	0.16	0.016	1029	-----	-----
OP#1	1997	360	0	0	0	0	196	0.0434	1699	0.1601	0.0126	1029	-----	14.89
OP#2	2337	0	743	0	1251	958	250	0.042	1687	0.16	0.0117	1029	-----	1.13
OP#3	1608	0	1891	703	586	0	140	0.0417	1688	0.16	0.0143	989	-----	4.54
2329	2335	0	0	864	0	0	229	0.037	1699	0.119	0.013	859	-----	-----
OP#1	2691	0	0	0	0	0	226	0.0396	1714	0.1357	0.013	860	-----	36.03
OP#2	2901	0	1593	0	0	610	250	0.036	1694	0.1207	0.0118	943	-----	18.79
OP#3	2622	0	1439	651	626	0	228	0.0371	1699	0.119	0.0106	857	-----	0.49
2333	1399	249	0	890	1991	0	186	0.042	1628	0.103	0.007	687	-----	-----
OP#1	1459	500	0	0	0	0	250	0.0453	1643	0.132	0.0073	836	---P--	114.62
OP#2	1569	400	2000	0	0	1146	165	0.0424	1628	0.1029	0.0065	727	-----	6.9
OP#3	1581	204	0	506	2500	0	223	0.0443	1632	0.0922	0.007	687	-----	20.16
2339	1910	0	0	0	0	0	206	0.044	1682	0.138	0.01	830	-----	-----
OP#1	2019	297	0	0	0	0	225	0.0467	1692	0.138	0.0099	831	-----	1.15
OP#2	2219	296	1664	0	7	0	202	0.0443	1682	0.1329	0.01	830	-----	4.44
OP#3	1838	26	352	435	924	0	198	0.0441	1682	0.1381	0.01	830	-----	0.38
2341	1307	0	0	0	0	0	203	0.045	1668	0.162	0.013	684	-----	-----
OP#1	1369	0	0	0	0	0	222	0.0491	1679	0.1626	0.0114	686	-----	20.39
OP#2	1589	469	2000	0	0	133	163	0.0453	1668	0.1619	0.0127	682	-----	1.4
OP#3	1120	469	0	19	978	0	202	0.0453	1668	0.1525	0.0124	683	-----	6.55
2343	1872	0	0	0	0	0	199	0.045	1682	0.162	0.01	664	-----	-----
OP#1	2183	149	0	0	0	0	250	0.0476	1686	0.162	0.0098	664	-----	10.26
OP#2	2332	0	999	0	0	282	249	0.0506	1677	0.1489	0.01	782	-----	43.05
OP#3	2239	105	0	350	0	0	250	0.045	1679	0.1498	0.009	666	-----	10.64
2351	1950	0	0	0	0	1019	203	0.044	1671	0.181	0.013	538	-----	-----
OP#1	2031	125	0	0	0	0	250	0.0495	1686	0.1832	0.0126	617	-----	48.99
OP#2	2207	0	2000	0	0	540	236	0.0509	1670	0.1803	0.013	552	-----	19.37
OP#3	1755	500	0	88	352	0	236	0.0478	1671	0.1801	0.0129	535	-----	9.77
2357	1607	0	0	0	0	0	206	0.049	1675	0.18	0.012	578	-----	-----
OP#1	1515	10	2	0	0	0	250	0.0495	1682	0.1802	0.0105	577	-----	8.67
OP#2	1726	0	2000	0	0	0	232	0.0529	1675	0.1777	0.0113	578	-----	9.69
OP#3	1491	250	0	19	396	0	243	0.0503	1675	0.1728	0.0108	579	-----	6.93

2362	2329	0	0	0	0	0	208	0.036	1668	0.096	0.006	675	-----	-----
OP#1	2351	0	0	0	0	0	250	0.0375	1663	0.094	0.0058	811	-----	31.12
OP#2	2097	0	1064	0	0	0	212	0.0409	1642	0.0922	0.006	837	-T----	276.48
OP#3	2781	0	0	1073	0	0	250	0.0321	1663	0.0376	0.0029	834	-----	100.64
2365	3000	0	0	0	0	0	196	0.03	1662	0.063	0.005	1061	-----	-----
OP#1	2710	0	936	0	0	0	250	0.03	1644	0.0468	0.0028	1061	-T----	169.83
OP#2	2508	0	2	0	0	0	236	0.0318	1629	0.0305	-0.0006	1223	-T----	384.87
OP#3	2349	1	0	0	0	0	247	0.0301	1627	0.0422	0.0047	1013	-T----	368.81
2369	2096	0	0	0	0	0	205	0.039	1654	0.166	0.012	613	-----	-----
OP#1	2231	0	0	0	0	0	250	0.0443	1656	0.1501	0.0087	675	-----	35.22
OP#2	2112	0	33	0	0	0	206	0.0459	1648	0.1477	0.0104	775	-T----	74.85
OP#3	2195	375	0	44	0	0	250	0.0391	1650	0.1193	0.0096	703	-----	47.14
2375	1691	0	0	0	0	703	200	0.045	1654	0.19	0.013	439	-----	-----
OP#1	1481	0	0	0	0	0	250	0.0503	1657	0.1893	0.0108	556	-----	41.55
OP#2	1540	0	2000	0	0	63	191	0.0519	1650	0.1852	0.013	502	-----	36.3
OP#3	1689	500	0	513	0	0	250	0.0482	1653	0.1409	0.0089	439	-----	34.21
2381	2604	0	0	0	0	0	204	0.034	1706	0.135	0.011	859	-----	-----
OP#1	2935	30	45	0	0	0	250	0.0358	1706	0.1255	0.0104	859	-----	12.44
OP#2	2960	0	1157	0	0	0	250	0.0335	1686	0.1252	0.0109	1021	-T----	197.23
OP#3	3087	0	0	701	0	0	250	0.0301	1698	0.1049	0.0089	916	-T----	77.94
2385	2047	0	0	0	0	0	199	0.043	1681	0.174	0.011	492	-----	-----
OP#1	2095	0	0	0	0	0	250	0.0456	1687	0.1735	0.0115	650	---P--	94.37
OP#2	2168	0	1654	0	0	751	241	0.0485	1666	0.1632	0.011	655	-T----	164.06
OP#3	2312	250	0	1050	0	0	250	0.0445	1676	0.1329	0.0073	530	-----	39.56
2387	2020	0	0	0	0	217	194	0.054	1669	0.177	0.011	430	-----	-----
OP#1	1902	0	0	0	0	0	250	0.0511	1669	0.1906	0.0119	541	---P--	124.38
OP#2	2305	0	1908	0	0	324	250	0.0499	1663	0.17	0.011	592	-----	64.16
OP#3	2087	57	0	697	0	0	250	0.0567	1664	0.1769	0.0101	439	-----	12.32
2392	2069	0	0	0	0	1521	188	0.039	1643	0.12	0.008	620	-----	-----
OP#1	2307	250	0	0	0	0	250	0.0442	1658	0.1447	0.0085	768	---P--	135.54
OP#2	2378	0	2000	0	0	966	209	0.0421	1642	0.1201	0.0073	782	-----	35.53
OP#3	2112	482	0	541	0	0	236	0.0398	1643	0.1185	0.008	621	-----	3.52
2394	1870	0	0	0	0	1649	187	0.043	1636	0.13	0.008	555	-----	-----
OP#1	1870	336	0	0	0	0	250	0.0484	1654	0.1601	0.0092	717	-T--P--	264.05
OP#2	1882	0	2000	0	0	2002	181	0.0475	1632	0.1267	0.008	555	-----	16.96
OP#3	1889	429	18	706	1994	0	226	0.045	1636	0.1174	0.0076	556	-----	14.58
2399	1992	0	0	0	0	646	201	0.052	1682	0.207	0.013	646	-----	-----
OP#1	1999	148	0	0	0	0	250	0.0485	1682	0.2026	0.013	646	-----	8.94
OP#2	2332	0	749	0	0	751	250	0.0478	1677	0.1828	0.013	743	-----	39.74
OP#3	2043	0	626	508	0	0	222	0.0513	1677	0.1911	0.013	648	-----	14.34
2400	1621	0	0	473	0	0	199	0.045	1682	0.192	0.013	683	-----	-----
OP#1	1738	22	123	0	0	0	250	0.045	1677	0.1908	0.0128	683	-----	5.37
OP#2	2107	0	358	0	0	500	250	0.0439	1677	0.1749	0.013	839	-----	38.96
OP#3	1904	125	0	88	0	0	250	0.0451	1678	0.1762	0.0129	691	-----	13.21
2405	1451	488	0	591	0	0	194	0.039	1705	0.142	0.008	762	-----	-----
OP#1	2036	500	0	0	0	0	250	0.0413	1722	0.1723	0.0119	915	-T--P--	575.15
OP#2	2251	0	1869	0	0	2776	250	0.043	1693	0.1138	0.008	924	-T----	133.75
OP#3	2034	82	174	920	508	0	227	0.039	1705	0.142	0.0079	761	-----	0.26
2409	2154	0	0	0	0	0	200	0.043	1658	0.144	0.006	528	-----	-----
OP#1	2349	11	0	0	0	0	250	0.0438	1667	0.1376	0.0066	689	---P--	143.13
OP#2	2007	0	1021	0	0	500	192	0.049	1641	0.1276	0.006	690	-T----	189.34
OP#3	2224	125	0	365	0	0	250	0.0443	1653	0.1194	0.0059	668	-----	51.58

2422	1490	0	0	0	0	1799	192	0.049	1678	0.17	0.011	424	-----	-----
OP#1	1335	250	0	0	0	0	250	0.0543	1696	0.2133	0.0126	568	-TMnP--	335.91
OP#2	1530	0	2000	0	0	2502	192	0.0559	1673	0.1625	0.011	425	-----	23.63
OP#3	1234	499	16	714	936	0	209	0.0536	1678	0.17	0.0094	424	-----	9.58
2430	1917	0	0	899	0	0	189	0.053	1687	0.163	0.011	530	-----	-----
OP#1	1958	1	0	0	0	0	250	0.0505	1701	0.193	0.0124	552	----P--	169.51
OP#2	2075	0	2000	0	0	184	236	0.0547	1683	0.1632	0.0109	539	-----	8.62
OP#3	1884	125	516	268	511	0	249	0.0532	1687	0.1629	0.0091	532	-----	0.75
2432	2097	0	0	896	0	29	183	0.05	1649	0.153	0.007	466	-----	-----
OP#1	2192	140	0	0	0	0	250	0.0496	1662	0.1734	0.0095	621	----P--	413.47
OP#2	2332	0	2000	0	0	837	250	0.0525	1644	0.1371	0.007	591	-----	46.87
OP#3	2275	106	0	883	134	0	246	0.0535	1649	0.1397	0.0069	463	-----	16.41
2442	1898	0	0	902	0	0	203	0.058	1678	0.168	0.009	418	-----	-----
OP#1	1723	0	0	0	0	0	250	0.0527	1682	0.1843	0.0102	508	----P--	182.86
OP#2	2009	4	1732	0	0	289	250	0.0567	1673	0.1585	0.009	574	-----	50.34
OP#3	1809	23	340	502	0	0	250	0.058	1673	0.168	0.008	456	-----	14.21
2446	2054	0	0	0	0	0	205	0.051	1685	0.15	0.008	491	-----	-----
OP#1	1955	0	0	0	0	0	250	0.0457	1685	0.151	0.0083	647	----P--	78.67
OP#2	1875	16	1816	0	10	270	244	0.0541	1663	0.1506	0.008	646	-T-----	231.3
OP#3	2222	0	0	810	0	0	249	0.0447	1678	0.1237	0.0056	655	-T-----	89.91
2448	1950	0	0	0	0	456	205	0.054	1659	0.184	0.009	444	-----	-----
OP#1	1826	0	0	0	0	0	250	0.0512	1664	0.184	0.0097	538	----P--	113.92
OP#2	2012	0	1500	0	0	375	250	0.0556	1654	0.1689	0.009	554	-----	41.28
OP#3	1848	169	0	432	0	0	250	0.0559	1654	0.1699	0.0089	444	-----	16.19
2452	1957	0	0	0	0	0	215	0.042	1677	0.164	0.008	540	-----	-----
OP#1	2153	3	0	0	0	0	250	0.043	1683	0.1509	0.0088	701	----P--	147.41
OP#2	2034	0	1869	0	0	817	233	0.0488	1656	0.1398	0.008	702	-T-----	237.02
OP#3	2293	109	0	751	0	0	250	0.0421	1672	0.1218	0.0065	662	-----	53.61
2456	1768	0	0	0	0	4	208	0.055	1653	0.195	0.009	436	-----	-----
OP#1	1584	0	0	0	0	0	250	0.0504	1653	0.1778	0.0094	555	----P--	94.36
OP#2	1723	0	362	0	0	1067	250	0.0568	1643	0.1652	0.009	570	-T-----	109.94
OP#3	1843	125	0	742	0	0	250	0.0551	1648	0.1524	0.008	436	-----	26.95
2458	2059	0	0	0	0	99	209	0.046	1671	0.167	0.009	576	-----	-----
OP#1	2285	250	0	0	0	0	250	0.046	1679	0.1647	0.0096	732	----P--	100.08
OP#2	2339	0	354	0	0	1001	248	0.0493	1664	0.151	0.0089	738	-T-----	73.88
OP#3	2195	250	0	437	0	0	250	0.0463	1667	0.1515	0.0088	577	-----	14.07
2460	2113	0	0	0	1387	2899	195	0.048	1619	0.151	0.009	550	-----	-----
OP#1	2034	500	0	0	0	0	250	0.052	1654	0.1927	0.0102	705	-TMnP--	517.62
OP#2	1960	480	1984	0	357	2307	144	0.0484	1619	0.151	0.0086	550	-----	0.99
OP#3	1926	457	0	832	2500	0	197	0.0481	1631	0.1407	0.009	549	-----	19.14
2466	1931	0	0	0	0	525	211	0.048	1668	0.139	0.01	713	-----	-----
OP#1	2251	321	0	0	0	0	250	0.0431	1681	0.1575	0.01	816	-----	50.56
OP#2	2241	0	1955	0	0	246	250	0.0475	1663	0.1519	0.0097	713	-----	15.29
OP#3	2019	15	999	850	0	0	202	0.0476	1664	0.1391	0.0098	711	-----	4.72
2468	1612	0	0	482	0	523	214	0.048	1660	0.158	0.009	661	-----	-----
OP#1	1718	492	0	0	0	0	250	0.0459	1675	0.1713	0.01	823	----P--	166.89
OP#2	1877	219	2000	0	0	782	248	0.0501	1659	0.157	0.009	661	-----	6.88
OP#3	1577	188	145	1185	506	0	177	0.0479	1660	0.1355	0.009	660	-----	14.75
2472	2049	0	0	707	0	2493	199	0.043	1614	0.107	0.007	641	-----	-----
OP#1	2349	313	0	0	0	0	250	0.0436	1662	0.1371	0.0089	803	-T-P--	704.59
OP#2	2038	422	2000	0	32	2456	154	0.043	1614	0.107	0.0064	641	-----	0.14
OP#3	1931	439	4	1251	2500	0	182	0.0431	1621	0.0943	0.007	624	-----	21.65



2484	1406	0	0	911	2527	0	206	0.044	1666	0.174	0.009	628	-----	-----
OP#1	1432	500	0	0	0	0	250	0.0486	1681	0.1807	0.0109	772	---P--	259.62
OP#2	1752	10	1935	0	93	2002	240	0.0509	1666	0.1442	0.009	627	-----	32.91
OP#3	1530	383	516	311	2500	0	233	0.0439	1667	0.139	0.009	625	-----	22.55
2488	1441	0	0	0	0	0	208	0.055	1681	0.228	0.015	404	-----	-----
OP#1	1205	0	0	0	0	0	250	0.0519	1676	0.2121	0.0125	525	-----	47.55
OP#2	1379	0	436	0	0	0	242	0.0591	1676	0.2175	0.015	520	-----	45.67
OP#3	1682	160	0	896	0	0	250	0.055	1676	0.1654	0.0087	405	-----	32.47
2490	2800	0	0	0	0	0	209	0.039	1702	0.159	0.01	765	-----	-----
OP#1	2935	414	0	0	0	0	250	0.0392	1704	0.1483	0.0121	926	---P--	240.32
OP#2	2974	0	1376	0	0	1130	249	0.0377	1678	0.1147	0.01	927	-T----	262.73
OP#3	2974	0	0	591	0	0	250	0.0348	1697	0.1259	0.01	849	-----	48.58
2492	2337	0	0	0	0	0	206	0.044	1666	0.143	0.009	620	-----	-----
OP#1	2447	379	0	0	0	0	250	0.0459	1681	0.1634	0.0103	782	---P--	205.49
OP#2	2513	0	2000	0	0	536	248	0.0479	1662	0.143	0.009	668	-----	20.16
OP#3	2224	321	0	701	0	0	222	0.0441	1666	0.1356	0.009	623	-----	6.3
2499	2961	0	0	0	0	0	230	0.04	1682	0.103	0.006	1160	-----	-----
OP#1	3082	500	0	0	0	0	250	0.0347	1686	0.1049	0.0074	1047	---P--	255.51
OP#2	3065	1	370	0	39	246	250	0.033	1671	0.088	0.006	1149	-T----	100.82
OP#3	2974	0	1939	701	0	0	230	0.0283	1676	0.0667	0.006	996	C-----	137.59
2514	2145	0	0	0	0	1187	205	0.05	1669	0.2	0.02	709	-----	-----
OP#1	1816	126	0	0	0	0	211	0.0524	1670	0.2006	0.0145	709	-----	6.6
OP#2	2278	250	395	0	447	375	248	0.0501	1669	0.2	0.0149	708	-----	0.31
OP#3	1767	194	133	96	1014	0	197	0.0499	1669	0.1999	0.0166	711	-----	0.55
2516	1953	0	0	0	0	1405	206	0.046	1659	0.152	0.01	796	-----	-----
OP#1	2114	500	0	0	0	0	250	0.0466	1674	0.1658	0.0107	811	---P--	95.3
OP#2	2310	156	1500	0	186	1064	235	0.0466	1659	0.1464	0.01	796	-----	5.08
OP#3	2214	0	0	714	2036	0	219	0.0452	1659	0.1469	0.01	734	-----	13.14
2518	2309	0	0	0	1781	3021	194	0.047	1637	0.135	0.009	758	-----	-----
OP#1	2877	500	0	0	0	0	250	0.0438	1696	0.165	0.0119	866	-T-P--	855.78
OP#2	2613	8	1636	0	1439	2940	220	0.047	1637	0.1348	0.0083	758	-----	0.28
OP#3	2515	118	1124	1356	2500	0	195	0.047	1652	0.135	0.0089	635	-----	31.27
2520	2038	0	0	0	0	1297	208	0.048	1660	0.132	0.009	791	-----	-----
OP#1	2173	486	0	0	0	0	250	0.0427	1670	0.1462	0.009	883	-----	43.13
OP#2	2229	0	1185	0	0	1044	250	0.0462	1655	0.1338	0.0083	802	-----	11.62
OP#3	2163	0	274	835	352	0	218	0.0442	1660	0.132	0.009	737	-----	14.91
2522	1651	0	0	1010	1087	0	211	0.05	1646	0.115	0.006	568	-----	-----
OP#1	2007	230	0	0	0	0	250	0.0458	1661	0.1401	0.0067	729	---P--	195.21
OP#2	1999	0	2000	0	0	630	226	0.0502	1643	0.115	0.0047	684	-----	23.29
OP#3	2019	32	203	736	626	0	247	0.0501	1645	0.1151	0.0047	565	-----	1.31
2527	2075	0	0	0	0	141	195	0.045	1645	0.142	0.009	796	-----	-----
OP#1	2285	147	856	0	0	0	250	0.0457	1645	0.1365	0.0085	795	-----	5.53
OP#2	2253	0	0	0	149	0	195	0.0444	1640	0.1327	0.0082	796	-----	12.76
OP#3	2322	0	47	431	39	0	222	0.0444	1645	0.1233	0.009	775	-----	18.56
2530	1653	0	0	812	0	0	211	0.053	1661	0.141	0.009	519	-----	-----
OP#1	1647	250	0	0	0	0	250	0.0486	1676	0.1837	0.0107	681	--MnP--	371.79
OP#2	1877	0	1793	0	0	2010	250	0.0527	1656	0.1437	0.0079	600	-----	22.98
OP#3	1757	78	751	1293	623	0	209	0.0531	1661	0.141	0.0073	519	-----	0.43
2534	2647	501	0	0	0	0	203	0.035	1699	0.128	0.012	1290	-----	-----
OP#1	2952	500	0	0	0	0	233	0.0339	1714	0.1345	0.012	1128	-----	37.31
OP#2	2974	0	0	0	401	747	241	0.03	1694	0.1344	0.0119	1128	-----	36.49
OP#3	2557	0	1908	865	1095	0	168	0.0301	1694	0.1125	0.012	1098	----O-	69.6

2536	2149	0	0	313	2443	0	189	0.046	1629	0.13	0.006	840	-----	-----
OP#1	2239	500	0	0	0	0	250	0.0476	1644	0.156	0.0081	791	----P--	398.92
OP#2	2451	67	1517	0	1100	626	231	0.046	1629	0.1296	0.0059	840	-----	0.34
OP#3	2449	0	500	1184	2287	0	210	0.0459	1629	0.1051	0.006	683	-----	39.83
2545	2385	0	0	421	0	144	200	0.052	1649	0.154	0.008	687	-----	-----
OP#1	2271	500	0	0	0	0	250	0.0494	1664	0.1619	0.0081	756	----P--	51.82
OP#2	2229	218	1374	0	64	238	223	0.0534	1649	0.1541	0.0079	687	-----	2.94
OP#3	2122	0	0	898	567	0	202	0.051	1649	0.1482	0.008	652	-----	10.72

Table A5.2 Optimization results for dataset D2

Heat#	O22	LIM2	DOL O2	ORE 2	RSL2	RDO LO2	HL2	C2	T2	Mn2	P2	Oact2	Violations	Cost
2551	1870	0	0	865	2510	4	187	0.048	1633	0.156	0.009	589	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1633	0.13	0.014	589	-----	-----
OP#1	1882	10	0	0	0	0	192	0.0512	1649	0.1793	0.0123	750	--Mn--	240.87
OP#2	2178	0	1609	0	0	2475	236	0.0474	1628	0.1317	0.0075	590	-----	7.66
OP#3	2007	250	1918	824	1657	0	206	0.0474	1633	0.1301	0.0088	586	-----	1.82
2553	1451	0	0	0	0	0	191	0.047	1695	0.164	0.015	756	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1695	0.41	0.096	756	-----	-----
OP#1	1410	14	498	0	0	0	247	0.0465	1694	0.1671	0.0133	757	-----	61.66
OP#2	1413	0	61	0	0	0	140	0.0484	1694	0.1936	0.0184	757	-----	56.79
OP#3	1393	52	0	23	152	0	223	0.047	1695	0.195	0.0147	757	-----	52.71
2555	1836	0	0	0	0	0	195	0.043	1679	0.18	0.012	686	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1679	0.21	0.014	686	-----	-----
OP#1	1958	0	0	0	0	0	250	0.0442	1679	0.1718	0.0119	738	-----	28.75
OP#2	1960	1	37	0	0	0	195	0.0446	1674	0.1695	0.0139	801	-----	44.75
OP#3	2038	218	0	110	469	0	250	0.0432	1679	0.1475	0.0104	687	-----	30.4
2561	1813	0	0	807	0	427	192	0.05	1661	0.153	0.01	564	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1661	0.21	0.014	564	-----	-----
OP#1	1528	183	6	0	0	0	250	0.0552	1661	0.1927	0.0107	564	-----	18.76
OP#2	1630	0	127	0	626	0	147	0.0542	1661	0.1941	0.0138	564	-----	16.04
OP#3	1432	236	0	12	171	0	217	0.0534	1661	0.1936	0.0118	566	-----	14.94
2563	1811	0	0	600	0	0	192	0.053	1662	0.174	0.009	445	-----	-----
AIM	0	0	0	0	0	0	0	0.053	1662	0.2	0.016	445	-----	-----
OP#1	1379	0	0	0	0	0	250	0.0564	1662	0.2035	0.0126	471	-----	14.09
OP#2	1662	30	362	0	225	313	172	0.0536	1662	0.1999	0.0142	445	-----	1.12
OP#3	1413	348	0	138	506	0	232	0.0544	1662	0.1964	0.0119	446	-----	4.73
2571	1741	0	0	758	0	0	189	0.045	1691	0.173	0.013	570	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1691	1.46	0.012	570	-----	-----
OP#1	1418	16	0	0	0	0	250	0.0503	1702	0.208	0.0141	612	---P--	288.37
OP#2	1726	0	2000	0	0	1251	250	0.0505	1687	0.1752	0.012	621	-----	113.44
OP#3	1870	234	0	765	2307	0	241	0.0449	1691	0.1537	0.0089	572	-----	90.02
2573	1967	0	0	1006	0	0	190	0.044	1687	0.144	0.01	560	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1687	1.46	0.012	560	-----	-----
OP#1	1471	0	0	0	0	0	250	0.0493	1689	0.1893	0.0127	627	---P--	173.49
OP#2	1804	0	2000	0	0	254	250	0.0484	1683	0.1685	0.012	646	-----	117.8
OP#3	2029	216	33	1139	626	0	234	0.0439	1686	0.1256	0.0076	563	-----	92.68
2581	2659	0	0	0	0	0	190	0.036	1698	0.15	0.012	941	-----	-----
AIM	0	0	0	0	0	0	0	0.036	1698	0.39	0.076	941	-----	-----
OP#1	2537	374	0	0	0	0	249	0.0413	1701	0.1468	0.011	941	-----	79.92
OP#2	2662	0	751	0	0	0	140	0.0363	1698	0.1412	0.0149	1007	-----	72.1
OP#3	2586	44	0	406	1012	0	214	0.036	1698	0.1397	0.011	942	-----	64.43
2583	3041	0	0	0	0	317	189	0.038	1711	0.168	0.015	906	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1711	0.39	0.076	906	-----	-----
OP#1	2943	124	694	0	0	0	248	0.0424	1711	0.1611	0.0135	904	-----	70.47
OP#2	3172	0	8	0	0	0	250	0.036	1706	0.1474	0.013	1018	-----	84.81
OP#3	3092	9	0	0	1877	0	245	0.038	1711	0.1596	0.0121	907	-----	59.27
2585	1921	0	0	0	0	0	191	0.035	1695	0.206	0.015	685	-----	-----
AIM	0	0	0	0	0	0	0	0.035	1695	0.39	0.076	685	-----	-----

OP#1	2234	0	0	0	0	0	250	0.0403	1708	0.1599	0.0114	824	-----	107.81
OP#2	2082	0	1875	0	0	0	158	0.0419	1688	0.1592	0.0139	847	-T-----	135
OP#3	2192	500	0	402	709	0	249	0.035	1695	0.1181	0.0077	686	-----	69.99
2587	2187	0	0	0	0	0	183	0.046	1684	0.181	0.015	612	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1684	0.39	0.076	612	-----	-----
OP#1	2036	0	0	0	0	0	250	0.048	1683	0.1806	0.0121	654	-----	66.45
OP#2	2195	0	248	0	0	0	250	0.0468	1679	0.1843	0.0126	711	-----	75.81
OP#3	2038	297	0	55	76	0	247	0.046	1684	0.1803	0.0117	612	-----	53.85
2603	2491	0	0	0	0	0	181	0.045	1683	0.146	0.008	472	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1683	0.2	0.016	472	-----	-----
OP#1	2016	0	0	0	0	0	250	0.049	1673	0.1792	0.0115	634	-T-----	111.71
OP#2	1877	0	0	0	0	0	170	0.0506	1665	0.1826	0.0138	634	-T-----	202.57
OP#3	2178	250	0	182	0	0	250	0.0454	1678	0.1522	0.0099	620	-----	61.05
2605	2264	0	0	0	779	0	182	0.05	1688	0.186	0.011	458	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1688	0.2	0.016	458	-----	-----
OP#1	1928	0	0	0	0	0	250	0.05	1683	0.1975	0.0126	612	-----	39.74
OP#2	1818	0	2	0	0	0	192	0.0522	1676	0.2028	0.0146	619	-T-----	125.21
OP#3	1921	204	0	41	0	0	250	0.05	1683	0.1887	0.0116	569	-----	34.89
2625	1797	0	0	4	0	0	179	0.047	1700	0.205	0.016	570	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1700	0.21	0.011	570	-----	-----
OP#1	1711	125	0	0	0	0	250	0.0471	1703	0.2128	0.016	721	---P--	485.41
OP#2	2036	0	1672	0	0	3730	250	0.0444	1668	0.1413	0.011	721	-T-----	369.64
OP#3	2271	31	751	1109	907	0	243	0.0467	1700	0.1645	0.011	572	-----	23.65
2629	1821	0	0	880	2039	0	179	0.048	1665	0.158	0.01	459	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1665	0.31	0.013	459	-----	-----
OP#1	1437	0	0	0	0	0	250	0.0533	1675	0.1975	0.0121	539	-----	75.03
OP#2	1572	134	1630	0	39	0	203	0.0544	1665	0.1846	0.0119	459	-----	53.78
OP#3	1305	500	0	36	975	0	238	0.0504	1665	0.1644	0.0098	459	-----	52.1
2633	1982	0	0	779	0	0	183	0.042	1675	0.149	0.008	517	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1675	0.31	0.013	517	-----	-----
OP#1	1899	0	2	0	0	0	250	0.0473	1680	0.1837	0.0114	670	-----	88.64
OP#2	1838	0	1011	0	0	0	172	0.0488	1670	0.1724	0.0128	674	-----	95.94
OP#3	2009	500	4	567	0	0	250	0.0423	1674	0.1208	0.0067	517	-----	62.56
2639	2150	0	0	460	0	123	189	0.041	1673	0.118	0.006	546	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1673	0.61	0.019	546	-----	-----
OP#1	1892	0	0	0	0	0	250	0.0456	1665	0.1624	0.0094	708	-T-----	151.54
OP#2	1723	0	1251	0	0	0	140	0.0483	1652	0.1565	0.0116	707	-T-----	307.16
OP#3	2349	149	0	798	0	0	250	0.041	1668	0.1022	0.0054	662	-----	109.5
2640	2640	0	0	735	0	0	147	0.049	1654	0.168	0.009	491	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1654	0.81	0.019	491	-----	-----
OP#1	2090	0	0	0	0	0	250	0.0537	1654	0.1913	0.0108	530	-----	94.31
OP#2	2043	0	121	0	0	0	154	0.0522	1649	0.1884	0.013	522	-----	94.43
OP#3	2114	437	8	29	313	0	248	0.049	1654	0.1664	0.0096	493	-----	79.96
2642	2343	0	0	0	0	0	148	0.037	1676	0.159	0.015	625	-----	-----
AIM	0	0	0	0	0	0	0	0.037	1676	0.81	0.019	625	-----	-----
OP#1	2349	0	0	0	0	0	250	0.0432	1686	0.1605	0.0126	759	C-----	154.26
OP#2	2207	0	936	0	0	0	151	0.0429	1671	0.1618	0.0155	787	-----	126.71
OP#3	2896	250	0	1263	1261	0	250	0.0373	1676	0.0892	0.0065	624	-----	89.96
2645	2593	0	0	0	0	536	136	0.044	1618	0.101	0.005	609	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1618	0.13	0.014	609	-----	-----
OP#1	2224	0	0	0	0	0	250	0.0476	1613	0.1269	0.0058	663	-----	24.52
OP#2	2273	0	14	0	0	0	164	0.0445	1613	0.102	0.0066	751	-----	51.11



OP#3	2351	2	0	101	0	0	250	0.049	1618	0.1081	0.0063	668	-----	37.95
2657	1968	0	0	997	0	1000	140	0.035	1633	0.075	0.005	735	-----	-----
AIM	0	0	0	0	0	0	0	0.035	1633	0.13	0.014	735	-----	-----
OP#1	2036	31	0	0	0	0	250	0.0404	1648	0.117	0.0069	832	-----	57.69
OP#2	1960	31	2000	0	34	0	167	0.0419	1633	0.1075	0.0082	861	-----	54.05
OP#3	1726	312	0	26	389	0	236	0.0409	1633	0.1073	0.0075	734	-----	34.43
2665	1643	0	0	0	0	0	161	0.041	1677	0.161	0.011	675	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1677	0.14	0.013	675	-----	-----
OP#1	1674	0	0	0	0	0	250	0.0463	1686	0.161	0.0097	692	-----	39.83
OP#2	1836	0	2000	0	0	434	144	0.0456	1677	0.14	0.0118	805	-----	30.52
OP#3	1726	301	0	90	1503	0	248	0.0423	1677	0.1398	0.008	676	-----	3.42
2669	1896	0	0	0	0	761	150	0.039	1682	0.158	0.011	655	-----	-----
AIM	0	0	0	0	0	0	0	0.039	1682	0.14	0.013	655	-----	-----
OP#1	1897	250	0	0	0	0	240	0.0461	1697	0.1647	0.0105	816	C-----	121.27
OP#2	1999	47	2000	0	0	809	160	0.0459	1682	0.14	0.0113	791	-----	38.53
OP#3	1765	418	0	197	1557	0	237	0.0411	1682	0.1398	0.0082	657	-----	5.93
2673	2194	0	0	204	0	0	148	0.047	1677	0.207	0.014	445	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1677	0.26	0.013	445	-----	-----
OP#1	1980	0	0	0	0	0	250	0.0523	1679	0.1906	0.0113	562	-----	66.33
OP#2	1980	0	248	0	0	0	241	0.0539	1672	0.195	0.0115	553	-----	68.94
OP#3	1889	500	0	166	0	0	250	0.0488	1673	0.1731	0.0094	445	-----	41.25
2679	2011	0	0	0	0	386	149	0.046	1666	0.172	0.012	456	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1666	0.26	0.013	456	-----	-----
OP#1	1774	0	0	0	0	0	250	0.0513	1663	0.1824	0.0106	584	-----	72.63
OP#2	1723	0	0	0	0	0	168	0.0525	1660	0.1799	0.0129	598	-T-----	92.58
OP#3	1892	499	0	349	0	0	250	0.0462	1661	0.1358	0.0077	471	-----	56.55
2683	1847	0	0	612	0	0	153	0.052	1671	0.217	0.014	413	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1671	0.26	0.016	413	-----	-----
OP#1	1393	0	0	0	0	0	250	0.055	1666	0.2213	0.0134	502	-----	47.02
OP#2	1432	0	45	0	0	0	250	0.0581	1666	0.2279	0.0138	445	-----	36.94
OP#3	1728	339	0	450	0	0	250	0.052	1671	0.1821	0.0104	413	-----	30.19
2684	2201	0	0	0	0	0	153	0.052	1672	0.156	0.01	485	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1672	0.41	0.016	485	-----	-----
OP#1	1816	0	0	0	0	0	250	0.0545	1667	0.1816	0.0098	512	-----	71.12
OP#2	1982	0	4	0	0	0	244	0.0545	1667	0.1738	0.0093	525	-----	75.79
OP#3	2043	195	0	389	0	0	250	0.052	1671	0.1584	0.0076	484	-----	62.57
2689	2393	0	0	0	0	2276	142	0.034	1626	0.1	0.007	649	-----	-----
AIM	0	0	0	0	0	0	0	0.034	1626	0.13	0.014	649	-----	-----
OP#1	2060	375	0	0	0	0	245	0.0478	1641	0.1438	0.0085	810	C-----	340.13
OP#2	2381	374	2000	0	76	0	142	0.0409	1635	0.1171	0.0094	811	-----	63.78
OP#3	1760	500	0	371	797	0	188	0.0404	1626	0.1119	0.0088	720	-----	43.6
2694	1895	0	0	0	0	693	156	0.041	1679	0.186	0.015	491	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1679	0.19	0.016	491	-----	-----
OP#1	1645	31	0	0	0	0	250	0.0497	1694	0.2038	0.0145	630	C-----	153.82
OP#2	1809	1	2000	0	0	817	170	0.0479	1679	0.1895	0.0158	586	-----	36.36
OP#3	1586	495	47	82	1933	0	247	0.0473	1679	0.1874	0.0122	496	-----	17.32
2698	1862	0	0	500	0	601	145	0.038	1671	0.145	0.011	530	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1671	0.19	0.016	530	-----	-----
OP#1	1723	0	0	0	0	0	250	0.0476	1686	0.1841	0.0127	664	C-----	181.49
OP#2	1801	29	2000	0	0	622	140	0.0468	1671	0.1694	0.0148	692	C-----	113.74
OP#3	1726	500	0	365	1212	0	245	0.0437	1671	0.1519	0.0097	529	-----	35.14
2705	2019	502	0	0	0	526	145	0.043	1676	0.162	0.012	480	-----	-----

AIM	0	0	0	0	0	0	0	0.043	1676	0.21	0.016	480	-----	-----
OP#1	1770	1	0	0	0	0	250	0.0499	1691	0.1995	0.0133	614	C-----	101.47
OP#2	1765	3	2000	0	0	246	149	0.0499	1676	0.1951	0.0156	562	-----	40.25
OP#3	1650	495	0	66	1405	0	250	0.048	1676	0.1821	0.011	478	-----	25.49
2711	1796	0	0	0	0	1518	149	0.042	1643	0.119	0.007	525	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1643	0.21	0.016	525	-----	-----
OP#1	1410	50	0	0	0	0	250	0.05	1658	0.1891	0.0114	629	C-----	128.77
OP#2	1550	142	2000	0	0	993	141	0.0489	1643	0.1622	0.0123	611	-----	55.74
OP#3	1266	500	0	7	1522	0	233	0.0477	1643	0.1631	0.0102	527	-----	36.47
2719	2546	0	0	0	0	0	160	0.039	1669	0.147	0.012	625	-----	-----
AIM	0	0	0	0	0	0	0	0.039	1669	0.36	0.076	625	-----	-----
OP#1	2344	0	0	0	0	0	250	0.0443	1672	0.1551	0.0102	736	-----	91
OP#2	2266	0	8	0	0	0	232	0.0451	1662	0.1672	0.0112	787	-T-----	125.23
OP#3	2662	312	0	876	0	0	247	0.0391	1669	0.1154	0.0069	625	-----	68.54
2724	1585	0	0	0	0	485	148	0.059	1646	0.186	0.016	375	-----	-----
AIM	0	0	0	0	0	0	0	0.059	1646	0.23	0.021	375	-----	-----
OP#1	1100	0	0	0	0	0	250	0.0536	1644	0.2041	0.0125	532	-----	65.07
OP#2	1100	1	110	0	0	0	249	0.0584	1644	0.2187	0.0129	375	-----	8.35
OP#3	1151	186	0	181	0	0	249	0.0594	1643	0.1993	0.0118	376	-----	17.02
2726	1817	0	0	0	0	0	152	0.038	1654	0.145	0.007	433	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1654	0.23	0.021	433	-----	-----
OP#1	1166	0	0	0	0	0	250	0.0507	1650	0.189	0.0116	595	C-----	288.82
OP#2	1361	0	2000	0	0	31	140	0.0499	1650	0.1721	0.0141	595	C-----	228.18
OP#3	1730	500	2	939	0	0	250	0.0438	1654	0.1082	0.0065	434	-----	68.94
2728	2064	0	0	309	0	0	144	0.041	1683	0.138	0.01	642	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1683	0.23	0.021	642	-----	-----
OP#1	2016	0	0	0	0	0	250	0.0412	1682	0.1566	0.012	803	-----	58.8
OP#2	1723	0	0	0	0	0	140	0.0446	1669	0.1767	0.0164	801	-T-----	160.91
OP#3	1928	312	0	47	0	0	250	0.041	1679	0.1467	0.0114	697	-----	49.19
2730	1626	0	0	534	250	0	140	0.042	1664	0.162	0.017	502	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1664	0.46	0.021	502	-----	-----
OP#1	1489	0	0	0	0	0	250	0.0476	1674	0.1801	0.0129	664	-----	123.83
OP#2	1491	0	1996	0	0	94	143	0.0488	1664	0.1875	0.0161	617	-----	98.42
OP#3	1933	430	0	924	1488	0	250	0.042	1664	0.1247	0.008	502	-----	72.95
2733	1663	0	0	772	0	0	150	0.046	1685	0.169	0.018	493	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1685	0.46	0.016	493	-----	-----
OP#1	1410	0	0	0	0	0	250	0.0515	1694	0.2039	0.0126	579	-----	98.74
OP#2	1491	1	2000	0	0	231	149	0.0529	1685	0.1858	0.0145	574	-----	91.09
OP#3	1369	500	0	417	2	0	231	0.0467	1685	0.1586	0.0092	494	-----	67.24
2741	1553	0	0	0	0	701	146	0.045	1674	0.192	0.014	486	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1674	0.46	0.016	486	-----	-----
OP#1	1296	0	0	0	0	0	250	0.0503	1681	0.2012	0.0131	605	-----	99.93
OP#2	1344	0	1994	0	2	20	142	0.0519	1674	0.1959	0.0159	558	-----	87.75
OP#3	1413	500	0	391	699	0	243	0.0459	1674	0.1544	0.0096	486	-----	68.54
2743	1267	0	0	0	0	1014	150	0.045	1685	0.191	0.015	567	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1685	0.14	0.013	567	-----	-----
OP#1	1232	278	0	0	0	0	249	0.0494	1700	0.2044	0.0131	729	--MnP--	354.61
OP#2	1567	0	1984	0	0	2749	188	0.0491	1680	0.1402	0.0109	729	-----	43.23
OP#3	1176	438	1828	723	389	0	209	0.0446	1685	0.14	0.0089	567	-----	1
2745	1681	0	0	512	0	0	155	0.052	1696	0.173	0.014	609	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1696	0.14	0.013	609	-----	-----
OP#1	1804	0	0	0	0	0	227	0.0467	1705	0.17	0.0126	747	-----	63.75

OP#2	1921	0	1986	0	0	110	250	0.0487	1691	0.1694	0.0118	634	-----	36.63
OP#3	1928	0	1361	1063	0	0	222	0.0483	1694	0.14	0.0085	609	-----	9.32
2749	2053	0	0	0	0	454	146	0.044	1680	0.186	0.012	468	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1680	0.18	0.014	468	-----	-----
OP#1	1845	0	0	0	0	0	250	0.0493	1689	0.1911	0.0132	627	-----	60.97
OP#2	1875	0	1998	0	0	145	187	0.0502	1675	0.1802	0.0139	620	-----	51.8
OP#3	1804	500	0	397	0	0	250	0.046	1679	0.158	0.0099	468	-----	17.71
2751	2366	0	0	0	0	0	149	0.048	1660	0.145	0.011	467	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1660	0.2	0.016	467	-----	-----
OP#1	1992	0	0	0	0	0	250	0.0492	1652	0.1588	0.0087	629	-T----	91.11
OP#2	2026	0	0	0	0	0	230	0.0496	1648	0.1569	0.0089	628	-T----	137.7
OP#3	2038	250	0	89	0	0	250	0.048	1655	0.1455	0.0082	582	-----	56.81
2753	1729	0	0	496	0	7	161	0.044	1685	0.181	0.012	567	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1685	0.14	0.013	567	-----	-----
OP#1	1958	0	0	0	0	0	250	0.0447	1697	0.1712	0.012	728	--Mn--	72.43
OP#2	1880	0	1593	0	0	12	249	0.0494	1680	0.1691	0.0113	729	-----	66.63
OP#3	2002	242	0	701	0	0	250	0.0445	1684	0.1383	0.0081	567	-----	3.18
2755	1769	0	0	748	0	0	160	0.038	1685	0.179	0.012	634	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1685	0.14	0.013	634	-----	-----
OP#1	1902	0	0	0	0	0	250	0.0432	1700	0.1643	0.012	759	-----	66.09
OP#2	1880	0	2000	0	0	497	173	0.0452	1681	0.1501	0.013	794	-----	63.45
OP#3	1726	445	0	182	623	0	247	0.0406	1685	0.1396	0.0095	635	-----	7.77
2756	1883	0	0	829	0	0	175	0.043	1665	0.183	0.014	615	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1665	0.14	0.013	615	-----	-----
OP#1	1884	0	0	0	0	0	224	0.0459	1680	0.17	0.012	774	-----	68.34
OP#2	2034	0	2000	0	0	915	199	0.045	1665	0.14	0.0111	774	-----	30.51
OP#3	1740	437	579	74	1405	0	243	0.043	1665	0.14	0.0096	615	-----	0.14
2757	1871	0	0	0	0	987	148	0.06	1668	0.165	0.011	470	-----	-----
AIM	0	0	0	0	0	0	0	0.06	1668	0.41	0.016	470	-----	-----
OP#1	1420	0	0	0	0	0	250	0.0556	1663	0.1995	0.0118	490	-----	67.85
OP#2	1643	0	0	0	51	0	183	0.0539	1668	0.2009	0.014	470	-----	61.19
OP#3	1513	3	0	5	310	0	248	0.06	1668	0.2161	0.0121	470	-----	47.5
2758	1617	0	0	946	1682	0	155	0.043	1674	0.176	0.011	590	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1674	0.14	0.013	590	-----	-----
OP#1	1530	249	0	0	0	0	246	0.0482	1691	0.1954	0.0134	752	-TMnP--	327.87
OP#2	1723	0	2000	0	0	2432	140	0.0471	1669	0.1409	0.0126	726	-----	38.18
OP#3	1474	449	749	773	626	0	209	0.0429	1674	0.1402	0.0096	588	-----	0.67
2759	2168	492	0	0	0	1014	157	0.046	1650	0.15	0.009	420	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1650	0.41	0.016	420	-----	-----
OP#1	1911	1	0	0	0	0	250	0.0523	1665	0.1979	0.0122	562	C-----	135.41
OP#2	1806	0	1996	0	0	0	154	0.0529	1650	0.1968	0.0139	461	-----	76.83
OP#3	2092	500	0	824	909	0	238	0.0467	1650	0.1427	0.0078	420	-----	66.93
2764	2348	0	0	0	0	1013	140	0.044	1632	0.13	0.007	553	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1632	0.13	0.014	553	-----	-----
OP#1	2165	0	0	0	0	0	250	0.0491	1636	0.16	0.0086	631	-----	52.35
OP#2	2346	0	2000	0	0	0	169	0.0443	1629	0.13	0.0087	676	-----	26.05
OP#3	2117	456	0	15	357	0	250	0.0454	1632	0.1298	0.0078	553	-----	3.4
2766	1713	0	0	0	0	1105	181	0.054	1626	0.176	0.011	400	-----	-----
AIM	0	0	0	0	0	0	0	0.054	1626	0.13	0.014	400	-----	-----
OP#1	1647	7	2	0	0	0	230	0.055	1642	0.1962	0.011	560	--Mn--	394.24
OP#2	1880	0	1689	0	0	1998	236	0.0528	1622	0.146	0.0066	400	-----	18.75
OP#3	1772	314	1875	900	941	0	216	0.0537	1626	0.13	0.0067	401	-----	0.85

2777	1655	0	0	0	0	1011	160	0.049	1665	0.165	0.012	542	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1665	0.2	0.016	542	-----	-----
OP#1	1102	0	2	0	0	0	243	0.0541	1666	0.2145	0.0136	542	-----	18.28
OP#2	1369	125	1750	0	76	70	141	0.0524	1665	0.1989	0.0158	542	-----	7.57
OP#3	1105	453	0	4	467	0	223	0.0493	1665	0.1836	0.0126	540	-----	9.44
2785	2114	0	0	0	0	497	150	0.041	1638	0.135	0.01	638	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1638	0.13	0.014	638	-----	-----
OP#1	2065	0	0	0	0	0	250	0.0463	1646	0.1511	0.009	692	-----	46.16
OP#2	2060	0	1875	0	0	0	173	0.0453	1633	0.13	0.0093	642	-----	15.74
OP#3	1726	499	0	0	0	0	222	0.0432	1636	0.1206	0.0089	641	-----	15.53
2787	1807	0	0	925	0	0	161	0.043	1651	0.151	0.009	591	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1651	0.31	0.013	591	-----	-----
OP#1	1933	0	0	0	0	0	250	0.0483	1660	0.1708	0.0099	649	-----	76.41
OP#2	1882	0	1992	0	0	0	188	0.0497	1646	0.1505	0.0097	597	-----	73.1
OP#3	1721	500	0	129	0	0	229	0.0438	1651	0.128	0.0083	595	-----	61.75
2790	2271	0	0	542	0	0	157	0.04	1697	0.189	0.019	858	-----	-----
AIM	0	0	0	0	0	0	0	0.04	1697	0.16	0.014	858	-----	-----
OP#1	2698	500	0	0	0	0	250	0.0412	1712	0.1802	0.0143	986	---P--	70.14
OP#2	2710	0	1754	0	0	497	249	0.0398	1692	0.165	0.0134	858	-----	8.45
OP#3	2615	2	311	710	1171	0	207	0.0398	1697	0.1601	0.0125	857	-----	0.6
2796	2011	0	0	832	0	0	163	0.04	1675	0.179	0.012	842	-----	-----
AIM	0	0	0	0	0	0	0	0.04	1675	0.16	0.014	842	-----	-----
OP#1	2261	500	0	0	0	0	250	0.0404	1690	0.1851	0.0141	1004	---P--	58.57
OP#2	2195	31	2000	0	37	0	222	0.0415	1675	0.1583	0.0134	842	-----	4.95
OP#3	1726	280	0	70	154	0	198	0.0399	1675	0.1508	0.0136	845	-----	6.34
2803	1450	0	0	909	1820	0	162	0.043	1650	0.176	0.011	463	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1650	0.21	0.014	463	-----	-----
OP#1	1183	0	0	0	0	0	250	0.0531	1665	0.2079	0.0124	544	C-----	168.21
OP#2	1520	0	2000	0	0	2248	140	0.0504	1650	0.1418	0.0113	625	C-----	95.55
OP#3	1217	498	0	301	1447	0	233	0.049	1650	0.1582	0.0093	461	-----	39.28
2805	1843	0	0	0	0	773	158	0.05	1666	0.174	0.014	476	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1666	0.21	0.014	476	-----	-----
OP#1	1471	0	0	0	0	0	250	0.0525	1661	0.2086	0.0135	558	-----	27.94
OP#2	1569	0	76	0	0	0	236	0.0538	1661	0.1948	0.0132	495	-----	23.8
OP#3	1493	244	2	11	7	0	247	0.0543	1664	0.1779	0.0118	478	-----	26.58
2811	2226	0	0	953	244	0	159	0.05	1657	0.149	0.008	489	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1657	0.21	0.014	489	-----	-----
OP#1	1437	0	0	0	0	0	250	0.0552	1652	0.1969	0.0107	497	-----	23.29
OP#2	1432	0	41	0	0	0	152	0.0566	1654	0.1888	0.0132	489	-----	26.34
OP#3	1569	247	0	1	154	0	248	0.0537	1657	0.1698	0.0096	487	-----	26.96
2813	2176	0	0	527	0	0	161	0.047	1667	0.15	0.009	521	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1667	0.21	0.014	521	-----	-----
OP#1	1818	0	0	0	0	0	250	0.0523	1665	0.1832	0.0102	562	-----	33.97
OP#2	1882	0	311	0	0	0	236	0.0538	1662	0.1668	0.0097	604	-----	55.63
OP#3	1882	422	0	86	0	0	250	0.047	1666	0.1418	0.0081	526	-----	34.31
2815	2680	0	0	0	0	1763	151	0.042	1632	0.113	0.007	729	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1632	0.13	0.014	729	-----	-----
OP#1	2828	36	0	0	0	0	176	0.0473	1664	0.1601	0.0117	890	-T-----	256.46
OP#2	2674	94	1001	0	78	2002	141	0.044	1632	0.1288	0.01	729	-----	5.64
OP#3	2310	373	1001	881	418	0	161	0.042	1632	0.1299	0.0102	730	-----	0.3
2818	2736	0	0	0	0	0	165	0.034	1700	0.12	0.008	643	-----	-----
AIM	0	0	0	0	0	0	0	0.034	1700	0.21	0.011	643	-----	-----

OP#1	2508	0	0	0	0	0	250	0.041	1696	0.137	0.0103	808	C-----	140
OP#2	2410	0	2000	0	0	0	195	0.0418	1673	0.1295	0.0107	811	CT-----	373.53
OP#3	2510	373	2	131	0	0	250	0.034	1696	0.1094	0.0087	796	-----	75.41
2828	1680	0	0	750	0	513	159	0.045	1692	0.132	0.007	558	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1692	0.21	0.011	558	-----	-----
OP#1	1503	7	0	0	0	0	250	0.0468	1692	0.1851	0.0126	683	---P--	184.05
OP#2	1674	0	1977	0	0	665	250	0.0496	1679	0.161	0.011	720	-T-----	159.48
OP#3	1413	375	0	41	0	0	250	0.0454	1687	0.165	0.0108	585	-----	31.87
2832	1917	0	0	504	0	0	140	0.035	1680	0.131	0.01	610	-----	-----
AIM	0	0	0	0	0	0	0	0.035	1680	0.21	0.011	610	-----	-----
OP#1	1843	0	0	0	0	0	250	0.0426	1693	0.1719	0.0131	773	C---P--	339.96
OP#2	1882	0	2000	0	0	755	250	0.0457	1671	0.1479	0.011	772	CT-----	240.83
OP#3	1564	500	0	86	46	0	247	0.0414	1680	0.1435	0.0108	609	-----	50.46
2834	2113	0	0	0	0	702	145	0.045	1635	0.139	0.008	528	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1635	0.13	0.014	528	-----	-----
OP#1	2036	0	0	0	0	0	243	0.0474	1648	0.1698	0.0115	689	--Mn---	154.77
OP#2	2192	0	2000	0	0	997	216	0.045	1631	0.131	0.0091	684	-----	33.91
OP#3	2068	301	4	702	230	0	234	0.0469	1635	0.1299	0.0088	529	-----	4.56
2836	2527	0	0	0	0	0	157	0.043	1691	0.128	0.009	693	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1691	0.91	0.012	693	-----	-----
OP#1	2165	18	10	0	0	0	249	0.0467	1691	0.1576	0.0106	694	-----	91.45
OP#2	2278	0	483	0	0	0	168	0.0452	1686	0.1378	0.0119	814	-----	112.5
OP#3	2295	135	8	454	0	0	243	0.043	1691	0.1237	0.0078	694	-----	86.61
2846	2576	0	0	889	1944	0	160	0.048	1652	0.14	0.006	457	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1652	0.21	0.014	457	-----	-----
OP#1	1985	0	0	0	0	0	250	0.0533	1652	0.1807	0.0091	540	-----	43.33
OP#2	1882	0	53	0	0	0	167	0.0548	1647	0.1685	0.0101	570	-----	63.63
OP#3	1906	500	0	73	0	0	250	0.0482	1647	0.1395	0.0069	470	-----	42.23
2848	2070	0	0	851	3258	0	148	0.03	1642	0.075	0.004	650	-----	-----
AIM	0	0	0	0	0	0	0	0.03	1642	0.13	0.014	650	-----	-----
OP#1	1770	0	0	0	0	0	250	0.0408	1647	0.132	0.0074	812	C-----	251.81
OP#2	1784	0	2000	0	0	0	143	0.0415	1637	0.0773	0.0072	833	C---O-	296.46
OP#3	1743	500	0	174	293	0	250	0.0365	1642	0.0341	0.003	687	-----	103.5
2854	1657	0	0	0	0	0	161	0.033	1673	0.136	0.01	784	-----	-----
AIM	0	0	0	0	0	0	0	0.033	1673	0.19	0.016	784	-----	-----
OP#1	1880	0	0	0	0	0	140	0.0383	1679	0.1412	0.0117	811	-----	52.16
OP#2	1765	50	452	0	64	0	140	0.0396	1673	0.1236	0.0111	784	-----	54.88
OP#3	1782	125	4	1	1562	0	140	0.0331	1673	0.1077	0.0102	784	-----	43.82
2856	2315	0	0	0	0	450	157	0.052	1662	0.171	0.012	449	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1662	0.41	0.016	449	-----	-----
OP#1	2029	0	0	0	0	0	140	0.0509	1657	0.1856	0.0135	568	-----	88.34
OP#2	2038	0	1155	0	0	0	250	0.0517	1658	0.1874	0.0116	449	-----	59.11
OP#3	1726	33	0	38	0	0	156	0.052	1657	0.2081	0.0143	498	-----	65.17
2858	2101	0	0	0	0	0	152	0.047	1681	0.176	0.014	498	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1681	0.41	0.016	498	-----	-----
OP#1	1767	0	0	0	0	0	140	0.0461	1664	0.1723	0.0129	660	-T-----	231.95
OP#2	1723	0	0	0	0	0	250	0.0497	1670	0.187	0.0127	652	-T-----	160.57
OP#3	1728	203	0	4	0	0	164	0.0407	1673	0.1604	0.0129	660	-T-----	141.38
2860	1991	0	0	0	0	0	153	0.05	1693	0.245	0.02	496	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1693	0.19	0.016	496	-----	-----
OP#1	1880	0	0	0	0	0	181	0.0494	1692	0.2195	0.0165	656	---P--	81.88
OP#2	2078	0	2000	0	0	0	250	0.0475	1688	0.2129	0.0155	542	-----	30.89



OP#3	2002	104	1312	809	0	0	216	0.0499	1688	0.19	0.013	570	-----	20.29
2866	2819	0	0	0	0	0	158	0.033	1671	0.115	0.007	672	-----	-----
AIM	0	0	0	0	0	0	0	0.033	1671	0.2	0.016	672	-----	-----
OP#1	2867	0	0	0	0	0	140	0.0336	1666	0.1025	0.0088	904	----O-	194.14
OP#2	2315	0	194	0	0	0	181	0.0387	1646	0.1201	0.0091	834	-T----	307.33
OP#3	2593	125	0	44	0	0	140	0.0303	1665	0.096	0.01	834	-T----	103.43
2868	2250	0	0	0	0	1499	164	0.045	1648	0.121	0.005	469	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1648	0.2	0.016	469	-----	-----
OP#1	1821	0	0	0	0	0	140	0.0503	1655	0.1424	0.0083	580	-----	70.88
OP#2	1767	0	1992	0	0	0	140	0.0519	1647	0.1336	0.008	522	-----	61.08
OP#3	1276	329	2	4	0	0	154	0.045	1643	0.1451	0.0089	501	-----	39.18
2870	2238	0	0	0	0	10	158	0.039	1674	0.165	0.011	550	-----	-----
AIM	0	0	0	0	0	0	0	0.039	1674	0.2	0.016	550	-----	-----
OP#1	2258	0	0	0	0	0	140	0.0435	1673	0.1535	0.0119	711	-----	65.42
OP#2	2217	0	1439	0	0	0	250	0.0451	1668	0.156	0.0106	712	-----	82.82
OP#3	1960	196	0	16	0	0	140	0.039	1670	0.1549	0.013	640	-----	43.16
2872	2296	0	0	0	0	0	166	0.043	1678	0.164	0.011	544	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1678	0.2	0.016	544	-----	-----
OP#1	2036	0	0	0	0	0	140	0.0438	1657	0.1549	0.012	706	-T----	236.45
OP#2	1867	0	14	0	0	0	245	0.048	1658	0.1702	0.0123	706	-T----	225.35
OP#3	1990	328	0	1	0	0	174	0.0366	1667	0.1336	0.0121	706	-T----	150.12
2874	2201	0	0	0	0	501	155	0.045	1660	0.156	0.008	424	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1660	0.2	0.016	424	-----	-----
OP#1	1855	0	0	0	0	0	140	0.0503	1656	0.1667	0.0113	580	-----	68.97
OP#2	1726	0	182	0	0	0	141	0.0518	1655	0.1817	0.0126	506	-----	48.55
OP#3	1569	187	2	10	0	0	140	0.0454	1655	0.174	0.0123	523	-----	42.3
2887	2606	0	0	0	0	0	156	0.041	1687	0.161	0.012	568	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1687	0.26	0.016	568	-----	-----
OP#1	2410	0	0	0	0	0	140	0.0425	1668	0.1464	0.0118	731	-T----	235.96
OP#2	2300	0	8	0	0	0	250	0.044	1668	0.1555	0.0106	730	-T----	236.12
OP#3	2349	232	0	0	0	0	160	0.0359	1678	0.1348	0.0117	730	-T----	135.92
2891	2258	0	0	0	0	0	153	0.036	1680	0.149	0.011	585	-----	-----
AIM	0	0	0	0	0	0	0	0.036	1680	0.26	0.016	585	-----	-----
OP#1	2427	0	0	0	0	0	140	0.0414	1675	0.1558	0.0125	752	-----	100.08
OP#2	2341	0	1255	0	0	0	250	0.0426	1669	0.1394	0.0099	747	-T----	167.18
OP#3	2351	117	0	179	0	0	140	0.036	1678	0.1341	0.0123	716	-----	72.96
2893	1993	0	0	0	0	0	168	0.038	1669	0.118	0.006	494	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1669	0.26	0.016	494	-----	-----
OP#1	1613	0	0	0	0	0	140	0.0433	1659	0.1394	0.0106	715	-T--O-	280.19
OP#2	1667	0	1435	0	0	0	166	0.0441	1659	0.1425	0.0105	656	-T----	148.92
OP#3	1471	483	2	25	0	0	141	0.0316	1664	0.1135	0.01	656	-----	115.03
2895	1506	0	0	451	0	3	155	0.047	1683	0.184	0.013	466	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1683	0.26	0.016	466	-----	-----
OP#1	1310	0	0	0	0	0	140	0.0478	1676	0.1899	0.0138	628	-T----	94.84
OP#2	1256	0	336	0	0	0	140	0.0507	1678	0.2048	0.0158	569	-----	56.38
OP#3	1139	72	2	15	0	0	175	0.047	1678	0.1897	0.0136	621	-----	65.35
2897	1616	0	0	0	0	0	154	0.042	1669	0.162	0.01	501	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1669	0.26	0.016	501	-----	-----
OP#1	1410	0	0	0	0	0	143	0.0463	1658	0.175	0.0119	662	-T----	149.7
OP#2	1405	0	61	0	0	0	154	0.048	1664	0.1773	0.013	651	-----	81.39
OP#3	1413	38	0	96	0	0	140	0.042	1664	0.1588	0.012	645	-----	72.64
2899	1690	0	0	621	618	0	156	0.04	1668	0.153	0.011	533	-----	-----

AIM	0	0	0	0	0	0	0	0.04	1668	0.26	0.016	533	-----	-----
OP#1	1633	0	0	0	0	0	140	0.0448	1668	0.1646	0.0128	686	-----	77.64
OP#2	1650	0	1713	0	2	0	140	0.0445	1663	0.1641	0.0128	533	-----	52.65
OP#3	1259	375	0	0	0	0	140	0.0401	1663	0.1606	0.0125	544	-----	45.36
2906	1670	0	0	0	0	750	148	0.046	1667	0.161	0.009	460	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1667	0.26	0.016	460	-----	-----
OP#1	1540	0	0	0	0	0	140	0.0499	1662	0.1746	0.0124	587	-----	74.03
OP#2	1423	0	248	0	0	0	140	0.0529	1662	0.189	0.0135	478	-----	50.9
OP#3	1335	93	0	81	0	0	140	0.0461	1662	0.1774	0.0128	545	-----	55.26
2914	1847	0	0	0	0	0	176	0.049	1675	0.185	0.013	603	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1675	0.16	0.014	603	-----	-----
OP#1	1801	0	0	0	0	0	140	0.0438	1673	0.1606	0.0128	706	-----	30.47
OP#2	1821	0	1918	0	0	4	250	0.0463	1670	0.1705	0.0116	612	-----	18.63
OP#3	1427	139	1752	142	0	0	230	0.049	1670	0.16	0.0106	664	-----	15.07
2923	2356	0	0	0	0	643	168	0.048	1660	0.168	0.01	467	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1660	0.21	0.014	467	-----	-----
OP#1	2126	0	0	0	0	0	140	0.0495	1655	0.1776	0.0116	596	-----	51.1
OP#2	1975	0	35	0	0	0	210	0.052	1655	0.1754	0.0111	599	-----	57.89
OP#3	2038	0	0	349	0	0	159	0.0476	1655	0.1695	0.0115	573	-----	47.81
2925	2507	0	0	0	0	0	177	0.045	1684	0.119	0.007	741	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1684	0.21	0.014	741	-----	-----
OP#1	2297	0	0	0	0	0	226	0.04	1679	0.1198	0.0077	902	-----	80.62
OP#2	2192	0	0	0	0	0	250	0.0437	1671	0.1243	0.0073	898	-T----	163.23
OP#3	2195	0	0	105	0	0	229	0.0397	1679	0.1114	0.0073	903	-----	85.4
2931	1886	0	0	0	0	111	169	0.039	1672	0.183	0.023	757	-----	-----
AIM	0	0	0	0	0	0	0	0.039	1672	0.21	0.014	757	-----	-----
OP#1	2403	156	29	0	0	0	140	0.0443	1682	0.1578	0.0129	757	-----	48.13
OP#2	2349	156	0	0	547	0	145	0.0419	1672	0.1643	0.013	751	-----	29.88
OP#3	2398	2	0	0	2500	0	154	0.0391	1677	0.1557	0.0126	757	-----	31.36
2932	1773	0	0	0	0	242	175	0.06	1655	0.193	0.012	516	-----	-----
AIM	0	0	0	0	0	0	0	0.06	1655	0.21	0.014	516	-----	-----
OP#1	1474	0	0	0	0	0	242	0.0571	1650	0.1946	0.0113	594	-----	32.35
OP#2	1804	127	31	0	286	0	250	0.0557	1655	0.1853	0.0106	516	-----	16.97
OP#3	1305	16	6	8	0	0	230	0.06	1650	0.21	0.0117	523	-----	6.44
2937	1521	0	0	0	0	211	187	0.055	1643	0.177	0.012	562	-----	-----
AIM	0	0	0	0	0	0	0	0.055	1643	0.21	0.014	562	-----	-----
OP#1	1217	0	0	0	0	0	240	0.0526	1638	0.185	0.0103	679	-----	42.56
OP#2	1413	93	198	0	115	0	250	0.0545	1643	0.1842	0.0107	562	-----	13.26
OP#3	1110	21	0	4	0	0	210	0.055	1638	0.1895	0.0113	571	-----	16.12
2941	1847	0	0	0	0	0	167	0.044	1628	0.156	0.008	687	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1628	0.13	0.014	687	-----	-----
OP#1	2012	0	0	0	0	0	140	0.044	1628	0.1347	0.0087	701	-----	5.74
OP#2	1997	0	1124	0	0	227	191	0.044	1626	0.13	0.008	688	-----	1.73
OP#3	1882	97	373	212	762	0	192	0.0439	1628	0.1301	0.0082	688	-----	0.28
2943	1243	0	0	0	0	235	184	0.045	1662	0.124	0.008	709	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1662	0.26	0.013	709	-----	-----
OP#1	1325	188	170	0	0	0	141	0.0482	1662	0.156	0.0104	709	-----	47.18
OP#2	1555	368	1222	0	152	0	140	0.0469	1662	0.1509	0.0104	709	-----	46.18
OP#3	1254	95	0	0	1562	0	198	0.045	1662	0.149	0.0092	701	-----	44.03
2944	1589	0	0	0	0	0	196	0.054	1655	0.203	0.012	516	-----	-----
AIM	0	0	0	0	0	0	0	0.054	1655	0.26	0.013	516	-----	-----
OP#1	1256	0	0	0	0	0	140	0.0532	1650	0.1845	0.0112	523	-----	37.08

OP#2	1254	3	51	0	301	0	140	0.0555	1655	0.1923	0.0129	516	-----	28.79
OP#3	1100	0	0	218	0	0	183	0.054	1650	0.1881	0.011	519	-----	32.97
2946	1935	0	0	0	0	0	185	0.043	1663	0.154	0.009	695	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1663	0.26	0.013	695	-----	-----
OP#1	1919	0	0	0	0	0	140	0.0433	1663	0.137	0.0101	716	-----	51.26
OP#2	1892	0	514	0	0	0	143	0.043	1662	0.1418	0.0107	697	-----	46.59
OP#3	1665	38	0	44	137	0	169	0.043	1663	0.1454	0.0104	695	-----	44.15
2948	2190	0	0	0	0	0	189	0.038	1671	0.093	0.005	794	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1671	0.23	0.021	794	-----	-----
OP#1	2388	0	0	0	0	0	140	0.0389	1671	0.0976	0.0075	800	-----	61.01
OP#2	2351	0	561	0	0	0	150	0.038	1667	0.1065	0.0078	906	-----	72.28
OP#3	1980	15	0	0	0	0	168	0.038	1667	0.1168	0.0086	801	-----	54.5
2952	1808	0	0	1010	0	118	172	0.04	1642	0.121	0.012	852	-----	-----
AIM	0	0	0	0	0	0	0	0.04	1642	0.13	0.014	852	-----	-----
OP#1	2192	428	0	0	0	0	140	0.0443	1657	0.1344	0.0106	852	-----	28.98
OP#2	2329	366	150	0	1395	497	157	0.04	1642	0.1303	0.0088	852	-----	0.26
OP#3	2046	196	753	1	2500	0	182	0.04	1654	0.13	0.0093	716	-----	27.64
2954	2008	0	0	947	0	0	177	0.041	1657	0.137	0.012	790	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1657	0.23	0.013	790	-----	-----
OP#1	2102	250	328	0	0	0	141	0.046	1657	0.1563	0.0119	791	-----	44.47
OP#2	2280	187	57	0	780	12	168	0.0412	1657	0.1519	0.0112	790	-----	34.45
OP#3	2227	9	0	0	2500	0	161	0.041	1660	0.1493	0.0113	732	-----	45.33
2958	1307	0	0	820	0	0	200	0.048	1693	0.165	0.016	694	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1693	0.19	0.013	694	-----	-----
OP#1	1254	94	0	0	0	0	202	0.0506	1698	0.1902	0.013	697	-----	10.72
OP#2	1596	81	1022	0	863	98	168	0.0488	1693	0.1805	0.013	694	-----	6.58
OP#3	1237	0	0	1	1408	0	202	0.048	1693	0.1844	0.0121	695	-----	3.12
2960	2308	0	0	0	0	0	200	0.042	1650	0.091	0.004	840	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1650	0.19	0.013	840	-----	-----
OP#1	1960	0	0	0	0	0	237	0.042	1645	0.1143	0.0065	879	-----	49.36
OP#2	2117	0	0	0	0	0	250	0.0416	1648	0.1174	0.0066	840	-----	41.04
OP#3	1968	0	0	0	389	0	216	0.042	1650	0.1145	0.0073	840	-----	39.89
2965	1983	0	0	0	0	0	217	0.037	1690	0.102	0.007	1120	-----	-----
AIM	0	0	0	0	0	0	0	0.037	1690	0.19	0.013	1120	-----	-----
OP#1	2185	364	135	0	0	0	246	0.0378	1690	0.1072	0.0078	1120	-----	45.86
OP#2	2349	4	0	0	108	0	224	0.037	1690	0.1022	0.0084	1075	-----	50.32
OP#3	2082	9	2	0	589	0	237	0.037	1690	0.0973	0.0079	977	-----	61.64
2967	1270	0	0	0	0	0	205	0.048	1679	0.159	0.009	725	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1679	0.19	0.013	725	-----	-----
OP#1	1354	0	0	0	0	0	213	0.0482	1679	0.1706	0.0114	725	-----	10.72
OP#2	1586	217	2	0	259	0	194	0.0481	1679	0.1747	0.0122	725	-----	8.14
OP#3	1293	0	0	0	604	0	223	0.049	1679	0.172	0.0109	724	-----	11.69
2969	1661	0	0	0	0	0	207	0.044	1679	0.134	0.012	788	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1679	0.19	0.013	788	-----	-----
OP#1	1726	0	0	0	0	0	206	0.0432	1674	0.1411	0.0089	811	-----	35.37
OP#2	1806	0	0	0	2	0	197	0.044	1675	0.1448	0.0097	787	-----	27.66
OP#3	1726	0	0	270	0	0	222	0.044	1676	0.1316	0.0077	791	-----	34.22
2973	1313	0	0	0	0	0	192	0.043	1657	0.156	0.009	752	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1657	0.19	0.013	752	-----	-----
OP#1	1459	70	280	0	0	0	177	0.0471	1657	0.1568	0.0104	752	-----	27.01
OP#2	1586	241	14	0	215	0	140	0.0465	1657	0.1582	0.0114	752	-----	24.99
OP#3	1489	1	0	0	1552	0	198	0.0446	1657	0.1473	0.0097	751	-----	26.25



2975	1809	0	0	0	0	0	188	0.046	1654	0.167	0.02	904	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1654	0.23	0.016	904	-----	-----
OP#1	1904	86	594	0	0	0	246	0.0463	1654	0.1593	0.0109	904	-----	31.5
OP#2	2327	5	0	0	1229	0	250	0.0406	1654	0.1286	0.0081	868	-----	59.76
OP#3	2129	3	0	0	2495	0	240	0.046	1654	0.1381	0.0084	816	-----	49.73
2980	1582	0	0	400	0	0	195	0.046	1677	0.184	0.012	714	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1677	0.23	0.016	714	-----	-----
OP#1	1748	161	47	0	0	0	144	0.0469	1677	0.1666	0.0111	715	-----	29.72
OP#2	1801	6	1032	0	95	0	140	0.0466	1677	0.1613	0.0118	714	-----	31.34
OP#3	1555	30	0	3	645	0	200	0.046	1677	0.1651	0.0105	714	-----	28.39
2984	1520	0	0	0	0	0	189	0.048	1670	0.159	0.015	692	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1670	0.14	0.013	692	-----	-----
OP#1	1689	0	0	0	0	0	145	0.0438	1677	0.1699	0.013	712	-----	39.69
OP#2	1748	0	1998	0	0	1122	250	0.0464	1665	0.1522	0.0103	692	-----	17.03
OP#3	1662	55	1687	762	467	0	243	0.048	1670	0.1401	0.0088	692	-----	0.11
2986	1415	0	0	266	0	91	191	0.052	1678	0.198	0.015	592	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1678	0.14	0.013	592	-----	-----
OP#1	1784	344	0	0	0	0	140	0.0479	1693	0.1761	0.0136	752	--MnP--	169.29
OP#2	1784	0	2000	0	0	1998	250	0.0519	1674	0.1481	0.0092	593	-----	10.3
OP#3	1765	63	1857	1306	765	0	250	0.0512	1678	0.14	0.0072	592	-----	1.57
2990	2142	0	0	608	0	0	198	0.057	1660	0.16	0.009	406	-----	-----
AIM	0	0	0	0	0	0	0	0.057	1660	0.2	0.016	406	-----	-----
OP#1	1845	0	0	0	0	0	140	0.0562	1655	0.1901	0.0133	466	-----	26.45
OP#2	1806	0	12	0	0	0	171	0.057	1659	0.1948	0.0138	406	-----	3.97
OP#3	1569	61	592	156	0	0	195	0.057	1655	0.2	0.0131	469	-----	20.54
2994	1848	0	0	0	0	0	198	0.056	1667	0.209	0.018	566	-----	-----
AIM	0	0	0	0	0	0	0	0.056	1667	0.2	0.016	566	-----	-----
OP#1	1647	0	0	0	0	0	230	0.0546	1662	0.1985	0.0126	625	-----	18.64
OP#2	1882	31	235	0	27	0	250	0.054	1667	0.1906	0.0129	566	-----	8.35
OP#3	1608	0	22	174	0	0	220	0.0558	1662	0.2	0.0131	571	-----	5.97
2996	2260	0	0	0	0	545	192	0.041	1633	0.145	0.01	755	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1633	0.13	0.014	755	-----	-----
OP#1	2720	132	2	0	0	0	140	0.0437	1648	0.1352	0.0088	755	-----	25.68
OP#2	2559	285	751	0	59	0	142	0.0413	1633	0.1299	0.0086	755	-----	0.82
OP#3	2613	80	111	78	2500	0	187	0.041	1640	0.13	0.0084	752	-----	7.53
3004	1827	0	0	746	0	0	202	0.057	1666	0.2	0.019	489	-----	-----
AIM	0	0	0	0	0	0	0	0.057	1666	0.18	0.014	489	-----	-----
OP#1	1611	0	0	0	0	0	140	0.0544	1661	0.1948	0.0126	502	-----	20.38
OP#2	1713	0	989	0	0	414	250	0.0565	1664	0.1827	0.0104	489	-----	4.07
OP#3	1342	125	2000	174	0	0	223	0.0564	1661	0.1804	0.01	512	-----	10.74
3008	1831	0	0	893	854	805	199	0.049	1708	0.177	0.014	872	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1708	0.41	0.016	872	-----	-----
OP#1	1880	475	829	0	0	0	152	0.0497	1708	0.1894	0.0158	871	-----	55.43
OP#2	2143	67	68	0	1559	0	245	0.049	1708	0.1879	0.0129	872	-----	54.2
OP#3	1821	0	0	3	2187	0	250	0.049	1708	0.1886	0.0122	782	-----	64.85
3010	2231	0	0	0	0	1029	201	0.055	1662	0.168	0.01	523	-----	-----
AIM	0	0	0	0	0	0	0	0.055	1662	0.18	0.014	523	-----	-----
OP#1	2031	0	6	0	0	0	161	0.0548	1662	0.1828	0.0119	523	-----	1.91
OP#2	2090	65	522	0	83	0	219	0.055	1662	0.1778	0.0109	523	-----	1.33
OP#3	1765	55	1476	163	0	0	202	0.055	1660	0.18	0.011	524	-----	2.15
3017	2276	0	0	0	0	544	202	0.043	1675	0.14	0.01	1144	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1675	0.18	0.014	1144	-----	-----

OP#1	2351	500	1500	0	0	0	249	0.0471	1675	0.1506	0.0114	1144	-----	25.87
OP#2	2740	0	0	0	1251	0	250	0.0416	1674	0.1244	0.0077	1001	-----	47.64
OP#3	2820	0	0	4	2500	0	250	0.0385	1688	0.1142	0.0079	982	-----	74.06
3019	1740	0	0	0	0	0	206	0.049	1657	0.166	0.011	773	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1657	0.21	0.014	773	-----	-----
OP#1	1437	2	88	0	0	0	250	0.049	1656	0.1637	0.0088	773	-----	23.59
OP#2	1726	232	141	0	108	0	243	0.049	1657	0.1504	0.0082	773	-----	28.41
OP#3	1508	0	0	0	858	0	245	0.049	1657	0.15	0.0079	772	-----	28.96
3021	1717	0	0	0	0	407	205	0.045	1658	0.153	0.01	687	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1658	0.21	0.014	687	-----	-----
OP#1	1892	12	51	0	0	0	143	0.0455	1658	0.1574	0.0115	687	-----	26.32
OP#2	1884	157	29	0	0	0	157	0.045	1658	0.1726	0.0126	687	-----	17.91
OP#3	1726	108	0	22	948	0	195	0.045	1658	0.165	0.0111	687	-----	21.46
3027	2233	0	0	0	0	0	189	0.041	1630	0.11	0.007	870	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1630	0.13	0.014	870	-----	-----
OP#1	2273	147	65	0	0	0	247	0.0463	1630	0.129	0.0061	871	-----	13.81
OP#2	2544	16	0	0	611	0	224	0.0411	1630	0.1083	0.0055	870	-----	16.88
OP#3	2522	0	0	0	2490	0	199	0.041	1630	0.1097	0.0065	821	-----	21.26
3028	2126	0	0	0	0	0	189	0.045	1630	0.124	0.007	737	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1630	0.13	0.014	737	-----	-----
OP#1	2239	124	121	0	0	0	144	0.0455	1630	0.1299	0.0084	736	-----	1.45
OP#2	2351	124	1062	0	384	0	250	0.0441	1630	0.1205	0.0057	737	-----	9.48
OP#3	2185	8	375	5	2187	0	197	0.045	1630	0.1299	0.0076	737	-----	0.23
3030	1442	0	0	0	0	1012	204	0.051	1655	0.175	0.012	635	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1655	0.18	0.014	635	-----	-----
OP#1	1256	250	0	0	0	0	140	0.0522	1659	0.1816	0.0122	635	-----	7.53
OP#2	1410	336	125	0	855	375	140	0.052	1655	0.1796	0.0121	635	-----	2.19
OP#3	1212	11	156	5	2500	0	203	0.051	1656	0.18	0.0108	635	-----	1.04
3034	1641	0	0	0	0	108	204	0.052	1656	0.208	0.018	527	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1656	0.23	0.016	527	-----	-----
OP#1	1410	0	0	0	0	0	166	0.052	1651	0.1914	0.0123	584	-----	32.97
OP#2	1528	161	192	0	20	0	188	0.052	1656	0.1995	0.0132	527	-----	13.3
OP#3	1278	31	0	0	0	0	168	0.0521	1655	0.2025	0.0133	527	-----	13.63
3035	1515	0	0	0	0	0	215	0.049	1672	0.2	0.016	726	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1672	0.23	0.016	726	-----	-----
OP#1	1325	0	29	0	0	0	222	0.049	1667	0.1966	0.0123	725	-----	19.26
OP#2	1579	124	0	0	271	0	240	0.049	1672	0.199	0.0132	726	-----	13.49
OP#3	1479	13	0	0	921	0	227	0.049	1672	0.1849	0.0118	726	-----	19.68
3039	1605	0	0	0	0	604	204	0.059	1687	0.219	0.02	617	-----	-----
AIM	0	0	0	0	0	0	0	0.059	1687	0.2	0.016	617	-----	-----
OP#1	1337	0	4	0	0	0	212	0.0537	1682	0.2194	0.0151	617	-----	23.61
OP#2	1716	0	0	0	0	997	250	0.0521	1687	0.2038	0.014	616	-----	13.77
OP#3	1361	44	2000	174	59	0	250	0.0559	1687	0.2002	0.0125	617	-----	5.4
3052	2349	0	0	0	0	0	211	0.04	1673	0.142	0.013	953	-----	-----
AIM	0	0	0	0	0	0	0	0.04	1673	0.41	0.016	953	-----	-----
OP#1	2381	398	530	0	0	0	140	0.0415	1673	0.1336	0.0112	952	-----	71.32
OP#2	2508	373	498	0	56	51	250	0.04	1673	0.1207	0.0084	955	-----	70.89
OP#3	2361	7	2	5	2500	0	216	0.04	1674	0.1231	0.0092	874	-----	79.05
3066	2156	0	0	989	0	0	207	0.049	1664	0.143	0.01	762	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1664	0.46	0.016	762	-----	-----
OP#1	1958	156	198	0	0	0	197	0.0491	1664	0.1683	0.0116	763	-----	63.76
OP#2	2185	31	16	0	982	0	250	0.0475	1664	0.1509	0.0092	762	-----	70.25

OP#3	2002	10	0	16	2151	0	243	0.049	1664	0.1579	0.0093	762	-----	65.74
3067	1830	0	0	579	0	0	217	0.048	1674	0.16	0.011	669	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1674	0.21	0.014	669	-----	-----
OP#1	1569	7	22	0	0	0	218	0.0517	1674	0.1918	0.0113	669	-----	16.49
OP#2	1762	62	16	0	154	16	140	0.0493	1674	0.1705	0.0122	669	-----	21.66
OP#3	1728	5	0	330	508	0	206	0.0481	1674	0.163	0.0097	670	-----	22.66
3071	1929	0	0	0	0	0	214	0.052	1675	0.234	0.018	570	-----	-----
AIM	0	0	0	0	0	0	0	0.052	1675	0.21	0.014	570	-----	-----
OP#1	1569	0	0	0	0	0	230	0.0508	1670	0.2038	0.0133	699	-----	32.87
OP#2	1726	0	498	0	0	0	250	0.0514	1672	0.2039	0.0139	579	-----	8.62
OP#3	1454	125	0	0	0	0	223	0.0523	1670	0.2038	0.0135	605	-----	14.72
3073	2079	0	0	0	0	487	212	0.051	1667	0.172	0.013	543	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1667	0.21	0.014	543	-----	-----
OP#1	1882	0	0	0	0	0	140	0.0519	1664	0.1845	0.0127	549	-----	18.13
OP#2	1884	8	0	0	10	0	144	0.051	1667	0.1832	0.0134	543	-----	12.88
OP#3	1726	0	0	254	0	0	170	0.051	1664	0.1888	0.0125	543	-----	13.11
3077	1880	0	0	0	0	1196	214	0.058	1660	0.191	0.014	689	-----	-----
AIM	0	0	0	0	0	0	0	0.058	1660	0.21	0.014	689	-----	-----
OP#1	1320	70	493	0	0	0	222	0.0549	1660	0.2098	0.0131	688	-----	5.75
OP#2	1684	290	6	0	921	0	250	0.0537	1660	0.1925	0.0111	689	-----	15.77
OP#3	1271	0	0	0	858	0	250	0.058	1660	0.2082	0.0114	613	-----	11.99
3085	1553	0	0	0	0	539	220	0.043	1669	0.166	0.012	560	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1669	0.19	0.013	560	-----	-----
OP#1	1442	0	0	0	0	0	164	0.0483	1673	0.1834	0.013	653	-----	37.09
OP#2	1501	0	1496	0	0	250	161	0.0495	1669	0.1738	0.013	560	-----	23.93
OP#3	1200	249	63	59	0	0	150	0.043	1669	0.1706	0.013	560	-----	11.11
3090	2503	0	0	0	0	0	220	0.044	1673	0.143	0.011	818	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1673	0.31	0.013	818	-----	-----
OP#1	2576	316	16	0	0	0	161	0.0456	1673	0.1482	0.0098	818	-----	55.31
OP#2	2544	19	55	0	17	0	195	0.0442	1673	0.133	0.0091	818	-----	57.61
OP#3	2486	23	0	0	1840	0	228	0.044	1673	0.1376	0.0084	818	-----	55.76
3093	2114	0	0	0	0	0	217	0.047	1669	0.159	0.01	729	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1669	0.31	0.013	729	-----	-----
OP#1	2114	182	20	0	0	0	164	0.0479	1669	0.1525	0.0099	729	-----	52.77
OP#2	2117	73	14	0	0	0	153	0.047	1669	0.1426	0.0103	729	-----	54.07
OP#3	1919	62	0	0	897	0	223	0.0472	1669	0.1488	0.009	730	-----	52.63
3100	2010	0	0	889	526	0	217	0.049	1678	0.145	0.009	662	-----	-----
AIM	0	0	0	0	0	0	0	0.049	1678	0.31	0.013	662	-----	-----
OP#1	1836	129	563	0	0	0	175	0.049	1678	0.1782	0.0116	661	-----	42.64
OP#2	1882	123	22	0	147	0	221	0.049	1678	0.169	0.0098	662	-----	45.53
OP#3	1569	8	2	42	0	0	202	0.049	1677	0.1714	0.0106	668	-----	46.82
3103	1898	0	0	889	568	0	222	0.05	1672	0.128	0.009	823	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1672	0.31	0.013	823	-----	-----
OP#1	1391	373	170	0	0	0	223	0.053	1672	0.1847	0.0108	825	-----	46.67
OP#2	1816	0	0	0	2248	0	250	0.0495	1672	0.1601	0.0081	823	-----	49.51
OP#3	1410	0	0	0	2380	0	250	0.0511	1672	0.1617	0.0085	784	-----	54.87
3108	3330	0	0	906	0	0	225	0.04	1713	0.109	0.008	777	-----	-----
AIM	0	0	0	0	0	0	0	0.04	1713	1.31	0.012	777	-----	-----
OP#1	3089	0	63	0	0	0	181	0.039	1712	0.1298	0.0091	777	-----	93.39
OP#2	3133	0	256	0	0	0	250	0.0359	1705	0.1202	0.0081	939	-T-----	160.79
OP#3	2820	0	0	21	0	0	230	0.0382	1708	0.1236	0.0091	920	-----	118.12
3112	3027	0	0	0	0	0	225	0.045	1691	0.135	0.01	1178	-----	-----

AIM	0	0	0	0	0	0	0	0.045	1691	0.2	0.016	1178	-----	-----
OP#1	2693	0	1863	0	0	0	250	0.0429	1686	0.1576	0.0141	1178	-----	30.69
OP#2	3155	61	0	0	623	16	250	0.0353	1686	0.131	0.0098	1015	C-----	139.02
OP#3	2977	0	0	0	1535	0	250	0.0377	1691	0.1242	0.0086	988	C---O-	113.24
3114	2934	0	0	0	0	515	226	0.045	1679	0.15	0.011	894	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1679	0.2	0.016	894	-----	-----
OP#1	2779	219	8	0	0	0	225	0.046	1679	0.172	0.0123	894	-----	16.17
OP#2	3053	12	0	0	540	0	250	0.0407	1679	0.1511	0.0113	864	-----	37.43
OP#3	2869	0	0	3	1786	0	250	0.045	1679	0.155	0.01	877	-----	24.4
3122	1935	0	0	0	0	545	221	0.055	1667	0.178	0.013	651	-----	-----
AIM	0	0	0	0	0	0	0	0.055	1667	0.2	0.016	651	-----	-----
OP#1	1818	172	1083	0	0	0	161	0.0505	1667	0.2002	0.0151	649	-----	8.6
OP#2	1914	187	0	0	621	16	250	0.0515	1667	0.1978	0.0132	651	-----	7.52
OP#3	1591	70	123	445	0	0	243	0.0549	1667	0.2001	0.0122	650	-----	0.67
3124	2327	0	0	0	0	0	223	0.043	1690	0.163	0.013	807	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1690	0.2	0.016	807	-----	-----
OP#1	2444	105	280	0	0	0	192	0.043	1690	0.1622	0.013	806	-----	19.14
OP#2	2583	0	0	0	306	0	250	0.0417	1690	0.1653	0.0129	797	-----	21.74
OP#3	2327	23	0	0	540	0	220	0.043	1690	0.1611	0.0118	808	-----	19.74
3126	2241	0	0	0	0	1218	224	0.059	1656	0.16	0.015	735	-----	-----
AIM	0	0	0	0	0	0	0	0.059	1656	0.23	0.013	735	-----	-----
OP#1	1826	446	0	0	0	0	200	0.0531	1651	0.213	0.0141	738	C---P-	119.62
OP#2	2038	0	0	0	1562	0	250	0.0521	1652	0.1926	0.0125	683	-----	38.91
OP#3	1569	0	0	0	310	0	250	0.0594	1656	0.2189	0.0128	659	-----	15.85
3128	2001	0	0	0	0	752	221	0.044	1691	0.154	0.011	753	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1691	0.23	0.013	753	-----	-----
OP#1	2351	436	475	0	0	0	147	0.0437	1691	0.169	0.0129	753	-----	27.28
OP#2	2351	97	6	0	284	0	237	0.044	1691	0.1702	0.0123	753	-----	26.11
OP#3	2031	79	4	12	464	0	219	0.0449	1691	0.1665	0.0119	752	-----	29.88
3130	1690	0	0	0	0	1402	226	0.05	1683	0.142	0.01	825	-----	-----
AIM	0	0	0	0	0	0	0	0.05	1683	0.23	0.013	825	-----	-----
OP#1	1469	2	248	0	0	0	236	0.0492	1679	0.1811	0.0123	824	-----	26.91
OP#2	1958	0	0	0	1361	0	250	0.0454	1683	0.164	0.0107	820	-----	38.55
OP#3	1423	0	0	1	633	0	250	0.0497	1683	0.1715	0.0108	806	-----	28.36
3136	1924	0	0	0	0	496	226	0.057	1645	0.139	0.009	497	-----	-----
AIM	0	0	0	0	0	0	0	0.057	1645	0.23	0.013	497	-----	-----
OP#1	1750	0	0	0	0	0	174	0.0515	1640	0.162	0.0089	501	-----	49.1
OP#2	1726	0	958	0	0	0	250	0.0542	1641	0.1533	0.0075	497	-----	42.64
OP#3	1550	1	0	21	0	0	195	0.0524	1640	0.1637	0.0084	600	-----	62.8
3141	2629	0	0	0	0	0	216	0.036	1678	0.14	0.011	1155	-----	-----
AIM	0	0	0	0	0	0	0	0.036	1678	0.46	0.021	1155	-----	-----
OP#1	2781	484	1763	0	0	0	183	0.0386	1678	0.1397	0.0133	1154	-----	76.95
OP#2	3009	70	0	0	885	0	250	0.0351	1678	0.1324	0.0106	1041	-----	83.59
OP#3	2979	1	10	316	2498	0	250	0.036	1678	0.1099	0.0071	995	-----	90.28
3142	2196	0	0	0	0	0	211	0.037	1690	0.178	0.019	1114	-----	-----
AIM	0	0	0	0	0	0	0	0.037	1690	0.39	0.076	1114	-----	-----
OP#1	2498	499	1795	0	0	0	182	0.041	1690	0.1645	0.0156	1114	-----	68.65
OP#2	2979	125	0	0	1740	0	250	0.0345	1690	0.1526	0.0126	1103	-----	68.8
OP#3	2740	62	0	279	2500	0	250	0.037	1694	0.1341	0.0099	956	-----	83.63
3148	2271	0	0	0	0	0	211	0.048	1689	0.156	0.014	953	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1689	0.39	0.076	953	-----	-----
OP#1	2207	0	14	0	0	0	249	0.0438	1684	0.1579	0.0123	953	-----	73.23

OP#2	2495	1	0	0	0	0	250	0.0411	1688	0.1599	0.0127	796	-----	90.51
OP#3	2153	0	4	0	2	0	250	0.0451	1689	0.1621	0.0113	876	-----	72.97
3152	2249	0	0	0	0	0	210	0.046	1674	0.175	0.017	748	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1674	0.61	0.019	748	-----	-----
OP#1	2410	417	500	0	0	0	158	0.046	1674	0.1883	0.0144	749	-----	69.46
OP#2	2464	125	4	0	467	59	250	0.0459	1674	0.1793	0.0133	748	-----	70.85
OP#3	2268	187	4	171	1249	0	243	0.0461	1674	0.1688	0.011	748	-----	72.77
3156	1844	0	0	371	0	14	205	0.053	1674	0.209	0.021	582	-----	-----
AIM	0	0	0	0	0	0	0	0.053	1674	0.2	0.016	582	-----	-----
OP#1	1916	240	628	0	0	0	143	0.0488	1674	0.2059	0.0153	583	-----	11.03
OP#2	1882	9	471	0	362	102	250	0.0517	1674	0.2	0.0141	582	-----	2.44
OP#3	1545	30	872	29	0	0	197	0.0529	1672	0.2004	0.0137	585	-----	2.81
3158	1549	0	0	325	0	526	204	0.057	1667	0.21	0.015	688	-----	-----
AIM	0	0	0	0	0	0	0	0.057	1667	0.2	0.016	688	-----	-----
OP#1	1486	500	0	0	0	0	176	0.0517	1673	0.2273	0.0163	687	---P---	49.25
OP#2	1721	78	23	0	1153	1423	250	0.052	1667	0.2003	0.0139	688	-----	8.97
OP#3	1371	1	1875	282	2463	0	250	0.0563	1667	0.2002	0.0123	688	-----	1.33
3160	1850	0	0	0	0	523	206	0.058	1677	0.225	0.02	648	-----	-----
AIM	0	0	0	0	0	0	0	0.058	1677	0.2	0.016	648	-----	-----
OP#1	1630	423	117	0	0	0	176	0.0528	1677	0.2207	0.016	650	-----	19.59
OP#2	1880	65	0	0	936	942	250	0.0519	1676	0.2	0.0137	643	-----	12.42
OP#3	1410	84	2000	235	1004	0	250	0.0567	1677	0.2004	0.0127	649	-----	2.56
3173	1933	0	0	0	0	743	206	0.047	1680	0.188	0.018	852	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1680	0.2	0.016	852	-----	-----
OP#1	2038	24	240	0	0	0	229	0.0467	1680	0.1849	0.0155	850	-----	8.37
OP#2	2505	0	0	0	1388	0	250	0.042	1680	0.1782	0.0145	837	-----	23.45
OP#3	2141	0	0	0	1874	0	250	0.0474	1680	0.1803	0.0124	841	-----	12.21
3178	1674	0	0	0	0	420	215	0.042	1668	0.154	0.012	891	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1668	0.2	0.016	891	-----	-----
OP#1	1909	218	1904	0	0	0	157	0.0426	1668	0.1507	0.0129	891	-----	26.22
OP#2	2124	303	131	0	645	0	239	0.042	1668	0.1393	0.0097	891	-----	30.38
OP#3	1882	26	0	0	2226	0	244	0.0422	1668	0.1263	0.0074	891	-----	37.3
3182	1388	0	0	0	0	92	214	0.043	1665	0.159	0.013	768	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1665	0.2	0.016	768	-----	-----
OP#1	1709	289	1730	0	0	0	141	0.046	1665	0.1542	0.0126	769	-----	29.95
OP#2	1943	425	80	0	374	0	182	0.0431	1665	0.1412	0.0092	768	-----	29.59
OP#3	1728	0	0	0	2295	0	204	0.0431	1665	0.1316	0.0079	768	-----	34.44
3184	1811	0	0	0	0	0	230	0.048	1668	0.148	0.013	855	-----	-----
AIM	0	0	0	0	0	0	0	0.048	1668	0.2	0.016	855	-----	-----
OP#1	1882	0	0	0	0	0	244	0.0425	1663	0.145	0.0106	957	-----	60.57
OP#2	2192	63	0	0	303	0	250	0.0414	1668	0.1339	0.0107	850	-----	47.61
OP#3	1726	0	0	0	0	0	250	0.0464	1665	0.1424	0.0088	856	-----	35.1
3200	2068	0	0	0	0	0	207	0.042	1672	0.172	0.015	894	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1672	0.2	0.016	894	-----	-----
OP#1	2212	359	22	0	0	0	211	0.0457	1672	0.1643	0.0133	895	-----	26.82
OP#2	2586	125	0	0	1249	12	250	0.0417	1672	0.1578	0.0125	854	-----	26.35
OP#3	2297	0	0	0	2500	0	250	0.0461	1672	0.1581	0.0102	860	-----	34.73
3202	2367	0	0	783	0	0	208	0.051	1667	0.177	0.016	624	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1667	0.2	0.016	624	-----	-----
OP#1	2134	363	246	0	0	0	160	0.0505	1667	0.2158	0.0159	622	-----	9.17
OP#2	2212	1	250	0	804	152	250	0.0509	1667	0.2001	0.0148	624	-----	0.41
OP#3	1928	246	0	1	1171	0	232	0.0512	1667	0.2	0.0131	623	-----	0.59



3209	1681	495	0	0	0	1107	206	0.046	1669	0.149	0.013	749	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1669	0.21	0.016	749	-----	-----
OP#1	1594	500	1744	0	0	0	142	0.0513	1670	0.1839	0.0142	749	-----	25.16
OP#2	1960	468	467	0	968	0	191	0.046	1669	0.162	0.0095	749	-----	22.92
OP#3	1435	6	0	4	2500	0	245	0.0522	1669	0.177	0.0097	750	-----	29.43
3210	2247	0	0	0	0	304	207	0.047	1670	0.166	0.012	735	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1670	0.21	0.016	735	-----	-----
OP#1	2366	484	903	0	0	0	147	0.0479	1670	0.1665	0.0129	736	-----	22.8
OP#2	2449	80	14	0	919	0	250	0.0469	1670	0.1629	0.0107	735	-----	22.71
OP#3	2175	99	0	1	1562	0	234	0.0484	1670	0.1646	0.01	736	-----	24.67
3226	1271	0	0	0	0	502	196	0.051	1672	0.224	0.014	760	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1672	0.41	0.016	760	-----	-----
OP#1	1193	181	1183	0	0	0	188	0.051	1672	0.2087	0.0151	762	-----	49.45
OP#2	1501	493	0	0	594	258	250	0.0509	1672	0.1939	0.0121	760	-----	52.91
OP#3	1244	3	6	372	1730	0	249	0.051	1672	0.1824	0.0105	760	-----	55.61
3232	1246	499	0	0	2079	449	203	0.039	1689	0.163	0.014	731	-----	-----
AIM	0	0	0	0	0	0	0	0.039	1689	0.91	0.012	731	-----	-----
OP#1	1750	500	0	0	0	0	141	0.0431	1704	0.1787	0.0136	712	----P--	243.56
OP#2	2038	90	1984	0	743	1060	169	0.039	1689	0.145	0.011	731	-----	84.1
OP#3	1804	313	0	1312	2366	0	240	0.0388	1689	0.1262	0.0084	730	-----	86.76
3234	1561	496	0	0	0	1116	205	0.043	1691	0.169	0.013	637	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1691	0.91	0.012	637	-----	-----
OP#1	1985	315	0	0	0	0	140	0.0429	1706	0.1819	0.014	644	----P--	261.16
OP#2	2048	7	1978	0	29	1138	212	0.043	1691	0.1577	0.0119	637	-----	82.76
OP#3	1726	83	1005	524	1251	0	181	0.043	1691	0.1565	0.012	637	-----	83.17
3236	1799	498	0	0	0	1534	206	0.044	1686	0.154	0.011	666	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1686	0.91	0.012	666	-----	-----
OP#1	1972	500	0	0	0	0	142	0.046	1701	0.1743	0.0127	659	----P--	155.9
OP#2	2043	108	880	0	303	1314	181	0.044	1686	0.1522	0.0099	666	-----	83.32
OP#3	1990	110	2	1386	1500	0	216	0.044	1686	0.1431	0.0092	665	-----	84.57
3242	2226	0	0	0	0	0	203	0.046	1704	0.21	0.021	799	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1704	0.41	0.016	799	-----	-----
OP#1	2537	444	250	0	0	0	182	0.0474	1704	0.198	0.0158	801	-----	55.02
OP#2	2813	193	0	0	616	0	250	0.0427	1704	0.186	0.0144	798	-----	61.87
OP#3	2679	8	0	526	1650	0	240	0.046	1704	0.1762	0.013	799	-----	57.13
3247	2664	0	0	0	0	0	204	0.045	1683	0.139	0.009	897	-----	-----
AIM	0	0	0	0	0	0	0	0.045	1683	0.41	0.016	897	-----	-----
OP#1	2434	23	117	0	0	0	236	0.045	1683	0.1765	0.0129	898	-----	57.13
OP#2	2828	250	0	0	244	0	250	0.0396	1683	0.1543	0.0119	897	-----	74.4
OP#3	2486	3	4	7	1249	0	250	0.045	1683	0.16	0.011	875	-----	63.6
3251	2335	0	0	0	4	220	205	0.055	1674	0.157	0.013	506	-----	-----
AIM	0	0	0	0	0	0	0	0.055	1674	0.41	0.016	506	-----	-----
OP#1	2258	0	143	0	0	0	167	0.0506	1673	0.1834	0.013	505	-----	64.55
OP#2	2195	0	497	0	0	0	250	0.052	1670	0.1844	0.012	517	-----	67.02
OP#3	2117	0	0	12	0	0	147	0.0486	1669	0.1867	0.0132	516	-----	72.9
3264	1736	0	0	0	0	379	212	0.043	1677	0.199	0.019	880	-----	-----
AIM	0	0	0	0	0	0	0	0.043	1677	0.46	0.021	880	-----	-----
OP#1	2016	481	1896	0	0	0	142	0.0451	1677	0.1818	0.0157	878	-----	65.54
OP#2	2293	462	174	0	740	31	245	0.043	1677	0.1739	0.0127	880	-----	62.24
OP#3	2339	3	0	876	2500	0	250	0.043	1678	0.1432	0.0092	856	-----	72.78
3269	1937	0	0	572	0	0	205	0.046	1660	0.111	0.012	1120	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1660	0.46	0.021	1120	-----	-----

OP#1	1738	2	1466	0	0	0	250	0.0437	1660	0.1225	0.0112	1120	-----	78.66
OP#2	2273	8	0	0	1769	0	250	0.0391	1660	0.1103	0.0075	974	-----	104.01
OP#3	2029	0	0	21	2500	0	250	0.0396	1662	0.097	0.0049	958	-----	108.95
3276	2275	0	0	0	0	0	207	0.042	1691	0.116	0.01	1129	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1691	0.41	0.016	1129	-----	-----
OP#1	2383	0	1112	0	0	0	250	0.0412	1690	0.1358	0.0119	1129	-----	70.24
OP#2	2818	0	0	0	655	0	250	0.0356	1691	0.1087	0.0087	977	-----	102.26
OP#3	2508	0	0	5	1339	0	250	0.0385	1691	0.1047	0.0073	976	-----	96.4
3278	2106	0	0	0	0	0	210	0.038	1673	0.134	0.011	1007	-----	-----
AIM	0	0	0	0	0	0	0	0.038	1673	0.41	0.016	1007	-----	-----
OP#1	2385	493	1161	0	0	0	180	0.0423	1673	0.1516	0.0129	1008	-----	74.6
OP#2	2745	271	0	0	1171	0	250	0.0379	1673	0.1203	0.009	1005	-----	71.15
OP#3	2747	49	6	786	2500	0	250	0.038	1673	0.0928	0.0055	917	-----	86.91
3282	1982	0	0	0	0	464	212	0.054	1672	0.178	0.015	658	-----	-----
AIM	0	0	0	0	0	0	0	0.054	1672	0.41	0.016	658	-----	-----
OP#1	1938	0	196	0	0	0	194	0.0487	1670	0.1968	0.0139	656	-----	63.72
OP#2	2068	106	14	0	169	27	250	0.0491	1672	0.1897	0.0135	658	-----	62.79
OP#3	1726	0	0	19	0	0	212	0.052	1669	0.1988	0.0133	658	-----	57.97
3289	2443	0	0	0	0	98	210	0.047	1647	0.167	0.014	685	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1647	0.21	0.014	685	-----	-----
OP#1	2351	500	530	0	0	0	140	0.0473	1648	0.161	0.0121	685	-----	24.47
OP#2	2381	58	45	0	921	0	226	0.047	1647	0.1581	0.0111	685	-----	24.87
OP#3	2100	278	0	3	1562	0	242	0.0481	1647	0.1566	0.0087	686	-----	27.92
3291	2155	0	0	0	0	99	214	0.051	1659	0.164	0.014	743	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1659	0.21	0.014	743	-----	-----
OP#1	2048	352	344	0	0	0	192	0.0514	1659	0.1983	0.0139	741	-----	6.74
OP#2	2312	35	23	0	1486	0	250	0.0489	1659	0.176	0.012	743	-----	20.26
OP#3	2029	0	0	0	2153	0	250	0.0538	1659	0.1871	0.011	743	-----	16.5
3295	2030	0	0	0	0	597	214	0.051	1656	0.14	0.01	788	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1656	0.21	0.014	788	-----	-----
OP#1	1809	0	18	0	0	0	242	0.051	1654	0.1682	0.0099	788	-----	22.33
OP#2	2173	0	0	0	1080	0	250	0.0474	1656	0.1429	0.0078	788	-----	39.12
OP#3	1794	0	0	0	780	0	250	0.0511	1656	0.1559	0.0078	784	-----	26.56
3297	2279	0	0	0	0	1553	218	0.042	1651	0.141	0.01	768	-----	-----
AIM	0	0	0	0	0	0	0	0.042	1651	0.21	0.014	768	-----	-----
OP#1	2351	498	1277	0	0	0	140	0.0472	1662	0.1823	0.0139	768	-----	36.52
OP#2	2434	437	47	0	623	27	140	0.0424	1651	0.1558	0.0105	768	-----	26.72
OP#3	2351	18	0	23	2500	0	222	0.0461	1661	0.1564	0.0093	769	-----	45.8
3299	2013	0	0	0	0	886	214	0.046	1645	0.142	0.012	890	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1645	0.21	0.014	890	-----	-----
OP#1	1992	449	1183	0	0	0	194	0.0508	1645	0.178	0.0127	889	-----	25.69
OP#2	2429	62	201	0	2187	4	250	0.0458	1645	0.1408	0.0085	890	-----	33.44
OP#3	2009	0	0	0	2500	0	250	0.0521	1645	0.1599	0.008	769	-----	50.84
3301	2171	0	0	198	0	0	214	0.046	1673	0.169	0.011	843	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1673	0.14	0.013	843	-----	-----
OP#1	2390	500	452	0	0	0	162	0.0433	1674	0.1698	0.013	841	-----	28.6
OP#2	2544	0	123	0	0	1674	250	0.042	1671	0.14	0.0104	843	-----	10.33
OP#3	2290	9	1969	304	1562	0	250	0.0459	1673	0.14	0.0087	842	-----	0.31
3306	2238	0	0	501	0	0	214	0.044	1662	0.139	0.01	874	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1662	0.21	0.016	874	-----	-----
OP#1	2381	385	18	0	0	0	195	0.044	1662	0.1472	0.01	873	-----	30.14
OP#2	2544	0	0	0	1007	0	250	0.0424	1662	0.1413	0.0096	870	-----	36.8

OP#3	2356	0	0	22	1874	0	247	0.0445	1662	0.1381	0.0078	875	-----	35.58
3309	1710	0	0	806	0	0	200	0.044	1646	0.148	0.009	825	-----	-----
AIM	0	0	0	0	0	0	0	0.044	1646	0.13	0.014	825	-----	-----
OP#1	2056	500	753	0	0	0	146	0.0424	1655	0.16	0.0116	827	-----	36.33
OP#2	2195	56	1875	0	941	661	249	0.043	1646	0.13	0.0086	826	-----	2.44
OP#3	1994	92	96	552	2500	0	250	0.044	1647	0.13	0.0063	821	-----	1.65
3311	1469	0	0	0	0	0	211	0.046	1669	0.174	0.015	826	-----	-----
AIM	0	0	0	0	0	0	0	0.046	1669	0.21	0.016	826	-----	-----
OP#1	1381	18	47	0	0	0	226	0.0462	1669	0.1893	0.0134	825	-----	10.41
OP#2	1738	188	0	0	1134	0	250	0.0459	1669	0.1796	0.0132	825	-----	14.75
OP#3	1449	16	0	0	1865	0	242	0.0464	1669	0.1656	0.0107	825	-----	22.19
3317	1741	0	0	537	0	0	209	0.047	1652	0.164	0.01	753	-----	-----
AIM	0	0	0	0	0	0	0	0.047	1652	0.41	0.016	753	-----	-----
OP#1	1916	154	1361	0	0	0	165	0.0471	1652	0.1631	0.0123	755	-----	60.73
OP#2	2051	124	61	0	797	4	234	0.047	1652	0.1539	0.0098	753	-----	62.54
OP#3	1840	103	0	129	1249	0	236	0.047	1653	0.1471	0.0079	753	-----	64.82
3321	1830	0	0	0	1344	2073	200	0.041	1633	0.138	0.008	968	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1633	0.13	0.014	968	-----	-----
OP#1	2026	500	1969	0	0	0	141	0.041	1648	0.1455	0.0125	967	-----	26.74
OP#2	2195	500	1249	0	1483	4	236	0.041	1633	0.13	0.0081	968	-----	0.47
OP#3	1806	121	0	0	2500	0	250	0.0429	1643	0.13	0.0062	857	-----	26.4
3323	1653	0	0	0	0	1215	200	0.041	1645	0.135	0.008	915	-----	-----
AIM	0	0	0	0	0	0	0	0.041	1645	0.13	0.014	915	-----	-----
OP#1	1804	467	1548	0	0	0	140	0.0405	1645	0.1342	0.0108	915	-----	4.74
OP#2	1948	174	282	0	1107	74	214	0.041	1645	0.13	0.0088	915	-----	0.13
OP#3	1726	0	0	0	2500	0	247	0.042	1646	0.1186	0.0056	915	-----	12.5
3327	1938	0	0	943	682	0	203	0.051	1661	0.163	0.009	714	-----	-----
AIM	0	0	0	0	0	0	0	0.051	1661	0.23	0.013	714	-----	-----
OP#1	1848	383	0	0	0	0	195	0.0521	1661	0.1986	0.0122	713	-----	16.94
OP#2	2019	76	0	0	1171	0	243	0.051	1661	0.1757	0.0104	714	-----	23.71
OP#3	1726	125	0	33	1562	0	250	0.052	1661	0.176	0.0095	715	-----	25.79